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New Species of Mosquitoes from Taiwan (Diptera: Culicidae)

Part V. Three New Subspecies of *Aedes* and Seven
New Species of *Culex**Jih Ching LIEN[†]*Taiwan Provincial Malaria Research Institute, Nankang, Taipei, Taiwan*

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Abstract

The present paper describes the larvae, pupae, males and females of three new subspecies of *Aedes* and seven new species of *Culex*. These mosquitoes are named *Aedes (Finlaya) elisiae vicarius*, n. ssp., *Aedes (Finlaya) pulchriventer alius*, n. ssp., *Aedes (Finlaya) aureostriatus taiwanus*, n. ssp., *Culex (Neoculex) lini*, n. sp., *Culex (Lophoceraomyia) hui*, n. sp., *Culex (Culex) neovishnui*, n. sp., *Culex (Culex) kangi*, n. sp., *Culex (Culex) tsengi*, n. sp., *Culex (Culex) neomimulus*, n. sp., and *Culex (Culex) murrelli*, n. sp. These mosquitoes were found exclusively in foot-hill areas of Taiwan Proper. Following the morphological descriptions, the distribution, biology, and systematics of the species are discussed.

This is the last of this series of papers describing new mosquitoes found from Taiwan Proper and adjacent islands. The present paper deals with a new subspecies of *Aedes (Finlaya) elisiae* in subgroup III (*Pseudotaeniatus*) of Group E (*mediovittatus*-group: *Gymnometopu*), a new subspecies of *Aedes (Finlaya) pulchriventer* of Group H (*geniculatus*-group:

Protomacleaya), a new subspecies of *Aedes (Finlaya) aureostriatus* in subgroup II (*aureostriatus*) of Group D (*aureostriatus*-group: *Hulecoeteomyia*), a new species of *Culex (Neoculex)*, a new species of *Culex (Lophoceraomyia)* in Group C (*mamilifer*-group), a new species of *Culex (Culex)* in *vishnui* group, and four new species of *Culex (Culex)* in *mimeticus*

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[†] Special contribution

group. The new species of *Culex* in *vishnui* group has so far been referred to in part as *Culex vishnui* and in part as *Culex pseudovishnui*. It is morphologically very distinct from *Culex pseudovishnui* in the larval stage. Evidence in literature indicates that this mosquito occurs in Japan, Okinawa, Taiwan, and Thailand. Two of the four new species of *Culex* in *mimeticus* group have obviously been referred to as *Culex mimulus* by some workers. Since these mosquitoes occur side by side in the same type of habitats, distinct species are not easily separated. The author has studied the progenies either from the gravid females

caught in traps or from the egg-rafts collected from breeding places. Although variation occurs within a species, certain constant taxonomic features are still observable. At present three distinct species including *Culex mimulus* s. str. are known to occur in Taiwan. Terminology used for description conforms to that of Belkin (1962) except that of wing-venation and male terminalia of *Culex*, which conforms in part to that of Barraud (1934) and in part to that of Baisas (1938). The following are the descriptions of the new species and new subspecies.

AEDES (FINLAYA) ELSIAE VICARIUS, N. SSP.

MALE. Head. Vertex with a patch of fairly broad curved pale scales on median area and nape, a patch of brownish black broad flat scales on each side of median pale patch toward front, a curved band of pale broad flat scales on each side along eye margin and lateral aspect, lateral to this pale band there is another patch of brownish broad flat scales, and another patch of pale broad flat scales below this dark patch, numerous upright forked brownish black scales on nape extending forward to front margin. Torus brown, with some broad white scales on inner side; antenna dark brown, plumose, last two flagellar segments long, with pubescence, the remaining segments short, all about the same length. Palpus slightly shorter than proboscis, last two segments slightly curved upward, with hair-tufts beneath, some white scales at base of apical seg-

ment. Proboscis dark brown on upper surface, with a pale scaling at sides in middle, pale beneath for whole length except for a small dark basal area and a small dark interruption some distance from apex. Thorax. Integument of mesonotum dark brown, covered with deep brown narrow curved scales with metallic sheen, marked with narrow lines of yellowish scales; a double median line from front continued back and dividing either side of prescutellar space, a pair of submedian lines ending in front of level of wing bases, and a pair of curved lines from scutal angle continued over wing bases, scales of the curved lines whitish instead of yellow. Some yellow narrow scales scattered over the dark area over wing bases, a small patch of elongate pale scales on each side in front of wing bases; pale scales on front margin of mesonotum

rather broad; scutellum with broad pale scales at base of midlobe, black at apex; narrow pale scales on lateral lobes; postnotum dark brown, bare; *apn* with a band of pale broad scales at middle, dark-scaled both anteriorly and posteriorly; *ppn* with a large median patch of black scales; upper and lower margins with broad white scales, no narrow yellow scales; pleural integument dark brown, the following pleural areas with patches of broad white scales; propleuron, paratergite, postspiracular area, subspiracular area, prealar below knob, upper and lower sternopleuron, and mesepimeron; some elongate pale yellow scales on prealar knob. Haltere pale, knob dark. Wings dark-scaled except for a short line of white scales on outer side of costa at base; squama fringed with brown hairs; alula with narrow dark drown scales along margin. Femora and tibiae of front- and mid-legs dark, with narrow longitudinal lines running whole length both in front and behind; hindfemur with similar but broader stripes; anterior pale line narrowly interrupted at some distance from tip; posterior pale line more widely interrupted; tibia with a short pale longitudinal line beneath at base; tip of all tibiae with some pale scales, first tarsal segment of all legs with a pale basal ring which is often incomplete beneath; white rings present over the first tarsal joint of foreleg, first two tarsal joints of hindleg, and first three tarsal joints of hindleg. *Abdomen*. Dorsum dark brown, with very narrow basal pale bands on tergites II-VIII, wider at sides; venter dark brown, with basal pale bands on sternites II-VIII, not always visible owing to shri-

nkage, numerous golden hairs present. *Terminalia* (Fig. 1, f-g). Sidepiece with a group of setae on basal tergomesal lobe; clasper rather short, with a strong spiniform and a row of 17-18 setae on apical three-fourths of inner margin and four setae on apical half of outer margin; claspette filament slightly broadened medially, apical part tapering to tip; claspette stem with 4-6 setae, filament and stem subequal in length; phallosome tube-like, simple; proctiger with a well-sclerotized paraproct spine and 6-7 cercal setae; ninth tergite with 4-8 setae on each lobe; ninth sternite with seven setae.

FEMALE (Fig. 1, a). Agreeing with male in general, differing only as follows: Palpus about one-fourth of proboscis, dark brown, with white scaling apically; antenna much less plumose.

PUPA (as Fig. 5, i-j).

LARVA (Fig. 5, a-h). *Head*. Antenna shaft slender, strongly spiculate, hair 1-A bifid, arising from basal third of antennal shaft; head hair 1-C slender, slightly curved inward, shorter than distance between bases of the hairs; 4-C tiny, bifid, 5,6-C on a transverse line at about level of antennal bases, with 5-6 simple branches; 7-C slightly posterior to bases of 5,6-C, with three plumose branches; 8-C single, slender; 9-C slender, bifid; 10-C single, slender; 11-C 6-7-branched; 12-C 5-branched; 13-C long, single; 14-C single, stout; 15-C 2-4-branched; mentum with 23 teeth; median hairs of mouth brush strongly pectinate. *Thorax*. Integument strongly spiculate; prothoracic hair O-P small, 7-10-branched; 1-3-P arising from a common plate; all very long and plumose; 1-P 2-3-branched; 2-P single; 3-P single or bifid; 4-P single; 5-P

with three long, plumose branches; 6-P single, plumose; bases of 5,6-P connected together; 7-P with four long plumose branches; 8-P small, bifid; 9-12-P arising from a common plate; 9, 10-P slender, single; 11-P small, 2-6-branched; 12-P single, strongly plumose, longer than 9, 10-P; 14-P small, bifid or trifid; mesothoracic hair 1-M modified into a strong simple spine on a large sclerotized base; metathoracic hair 1-T modified into a single or bifid spine on a large base. *Abdomen.* Integument strongly spiculate; hair 1-I modified into a single or bifid spine on a sclerotized plate; hairs 1, 2, 4-VIII all single; 3-VIII with six long plumose branches; 5-VIII bifid, simple; comb of about 60 apically fringed teeth; siphon spiculate, siphon index about 2.5 times in compressed specimens; acus present; hair 1-S modified into a strong plumose spine which is occasionally bifid, inserted at basal two-thirds of siphon; pecten of 15-20 long pointed teeth on basal three-fifths of siphon, each with 3-7 lateral denticles; anal segment with strongly sclerotized saddle occupying about two-thirds of segment, membranous area of segment much more strongly spiculate than saddle, posterior border of saddle strongly spiculate; 1-X single, plumose; 2-X with 3-4 long branches; 3-X single, long; 4-X consisting of 12 hairs, all on barred area, each with 4-6 branches; anal gills pointed, more than twice as long as anal saddle.

TYPE SPECIMENS. Holotype, male (76252.1) with larval and pupal skins, *ex* concrete water tank, Chungho (1800 m), Chuchi, Chiai Hsien, Taiwan, November 17, 1961, P. S. Chen; allotype, female (76252.2) with larval and pupal skins,

same data as for holotype; paratypes, five males (76252.3, .4, .6, .7, .9), and four females (76252.5, .8, .10, .11) with corresponding larval and pupal skins, same data as for holotype. The specimens are in the collection of Taiwan Provincial Malaria Research Institute, Nankang, Taipei, Taiwan, Republic of China.

DISTRIBUTION. Known also from Paopu, Wulai and Shihting, Shihting in Taipei Hsien; Hsinlo and Yihsing, Chien-shih in Hsinchu Hsien; Fuhsing, Hsinshe and Machukeng, Tungshih in Taichung Hsien; Chukou, Fanlu in Chiai Hsien; Chulin and Kuanhsing, Luku and Menpaitan, Shuili in Nantou Hsien; Takangkou, Fengping and Sanchan, Hsiolin in Hualien Hsien; Machiahai, Changpin and Chupeng, Peinan in Taitung Hsien, Taiwan.

BIOLOGY. The larvae breed usually in rock pools and occasionally in concrete water tanks. They were found in association with *Aedes japonicus shintienensis*, *Aedes hatorii*, and *Culex bicornutus*. The habits of the adults are unknown.

SYSTEMATICS. The mosquito, in most respects, shows a close resemblance to *Aedes elsiae* and is therefore described here as a new subspecies of *Aedes elsiae*. It differs from type species chiefly as follows: The venter of adults mainly dark brown instead of "mainly yellowish"; a patch of broad dark scales sandwiched by two patches of broad white scales on upper and middle aspects of *ppn* instead of "narrow yellow and broad white scales on lower border of *pfn*"; antennal hair 1-A of larva inserted at about basal third of shaft and bifid instead of "at about middle" and "with 3-5 branches"; thoracic and abdominal integument densely spiculate. The male terminalia is almost indistinguishable from that of type species.

AEDES (FINLAYA) PULCHRIVENTER ALIUS, N. SSP.

MALE. *Head.* A somewhat triangular-shaped patch of narrow golden scales on median surface of vertex; a patch of dark brown broad flat scales on either side of median golden patch toward front; lateral and ventral surface covered with broad flat scales, which are all white except for a small black area toward front laterally; numerous dark upright forked scales on dorsal surface, chiefly on nape. Torus dark brown, with a few golden scales on inner side; antenna plumose; flagellar segments light brown; last two segments much longer than each of the remaining segments, with brown pubescence; hairs brown. Clypeus, palpus, and proboscis entirely black; palpus about three-fourths length of proboscis, penultimate segment somewhat upcurved, some slender hairs on underside of last two segments. *Thorax.* Integument of mesonotum black, mostly covered with golden narrow scales which form a wide median line, narrowing posteriorly and dividing at either side of prescutellar bare space, a curved line on each side over wing bases, a small patch on each side near margin a little before wing bases, and a short thin line on each side along anterolateral margin; the remaining area of mesonotum covered with brownish black narrow scales. Scutellum with narrow golden scales on each lobe. Postnotum dark brown, bare. *Apn* and *pbn* dark brown, with fairly broad yellowish white scales, with no narrow golden scales. Pleura brownish black except for narrow lighter stripes along sutures; a patch each of yellowish white scales

present on propleuron, subspiracular area, postspiracular area, paratergite, prealar below knob, upper and lower sternopleuron and upper mesepimeron. Haltere brown, knob somewhat darker. Wings dark-scaled; squama fringed with golden hairs; alula with narrow brown scales along margin. Legs brownish black; all femora with pale knee spot; forefemur with a very thin line of pale scales on basal two-thirds anteriorly; a broad pale stripe posteriorly on basal four-fifths; midfemur dark anteriorly with a broad pale stripe posteriorly on basal three-fifth; hindfemur pale on both surfaces of basal half except dorsally; tibiae and tarsi entirely dark. *Abdomen.* Dorsum black with lateral silvery patches on tergite I; narrow basal silvery bands on tergites II-V; these bands widening somewhat latelly; tergites VI-VIII with baso-lateral patches; apical margin of tergite VIII and dorso-basal half of sidepiece covered with silvery scales; some orange scales on lateral margins of tergites; sternites II-VII with baso-lateral triangular patches of silvery scales; narrow black bands medio-basally extending toward sides along posterior edge of the triangular patches; remainder covered with golden scales; sternite VIII with some light golden scales, apex with a tuft of golden scales. *Terminalia* (Fig. 1, h). Clasper broad on basal half, abruptly narrowed on apical half, with a short spiniform and 2-3 small setae; sidepiece rather broad, with a row of scale-like setae on apical half of sternomesal margin, a group of numerous setae on basal half of tergomesal margin

and six long setae on tergomesal lobe; claspette filament slightly broadened medially, apical part tapering to tip; claspette stem protruded beyond insertion of filament, spiculate; phallosome tube-like, simple; proctiger simple, with a well-sclerotized paraproct spine and two cercal setae on each lobe; ninth tergite bilobed, lobes very close together, each with 13-14 setae; ninth sternite with five setae.

FEMALE (Fig. 1, b). Agreeing with male in general, differing only as follows: Torus dark brown, with a patch of golden scales on inner side; antenna much less plumose, all flagellar segments about equal in length; palpus about one-fifth length of proboscis; broad pale stripes on posterior surface of fore- and mid-femur extending to apex as thin line and dots; dorsum of abdomen dark, with lateral silvery spots on tergite I; narrow basal silvery bands on tergites II-III; baso-lateral patches on tergites IV-VIII; apical margin of tergite VIII dark; sternite VIII with light brown scales; no golden tuft on apex of sternite VIII.

PUPA (as Fig. 6, g-h).

LARVA (Fig. 6, a-f). *Head*. Antenna of moderate length, about ten times as long as greatest width; shaft spiculate; hair 1-A with 2-4 plumose branches, arising at about middle; head hair 1-C rather slender, single; hairs 5-7-C arranged in a convex row toward front of clypeus; 4-C slightly posterior and internal to 5-C; 4-C small trifid; 5-C with five coarse branches; 6-C with three coarse branches; 7-C with four plumose branches; 8-C slender, single, rather long; 9-C slender, rather long, single or bifurcated

apically; 10-C single, slender, rather long; 11-C stellate, with eight branches; 12-C bifid; 13-C single, long; 14-C single or bifid, rather coarse; 15-C bifid; mentum with 25 teeth; median hairs of mouth brush strongly pectinate. *Thorax*. Integument glabrous; hair 0-P small, with 7-8 fine branches; 1-P with 4-5 long plumose branches; 2-P single, plumose; 3-P with 7-8 plumose long branches; 4-P single; 5, 6-P with their bases touching; 5-P with 2-3 plumose long branches; 6-P single, long, plumose; 7-P trifid, long, plumose; 8-P fairly large, with 8-10 plumose branches; 10-12-P arising from a common plate; 9, 10-P both single, plumose; 11-P small, bifid or trifid; 12-P single, plumose, longer than 7, 10-P; 14-P large, with 5-7 plumose branches. *Abdomen*. Integument with very sparse, inconspicuous, blunt spicules; hair 1-VIII single; 2-VIII single, coarser, plumose; 3-VIII with 10-12 plumose long branches; 4-VIII single; 5-VIII trifid, coarse, plumose; comb of about 70 apically and laterally fringed teeth, arranged in a triangular patch. Siphon with acus, about three times as long as greatest width; pecten of 26-30 long sharp teeth, each tooth with 2-6 small basal denticles; hair 1-S with 4-5 plumose long branches, arising at three-fifths from base. Anal segment with well-sclerotized saddle covering dorsal half of segment, numerous minute spicules on saddle, posterior margin with long sharp spines; hair 1-X single, coarse, plumose; 2-X bifid, very long, about three times as long as saddle; 3-X single, very long; 4-X consisting of 12 hairs, each with 2-5 long branches on barred area; membranous part of segment with fine hair-like spicules; anal gills long and

pointed, more than twice length of saddle.

TYPE SPECIMENS. Holotype, male (85053.2) with larval and pupal skins, *ex* concrete water tank, Lishan (2400m), Hoping, Taichung Hsien, Taiwan, February 8, 1961, T. S. Lo; allotype, female (85053.3) with larval and pupal skins, same data as for holotype; paratypes, two males (85053.4, 85055.1) and two females (85053.1, 85055.2) with corresponding larval and pupal skins, and 11 males (85053.5, .6, .7, .8, .9, .10, .11; 85055.4, .5, .6, .7) and ten females (85053.12, .13, .14; 85055.8, .9, .10, .11, .12, .13, .14) without larval and pupal skins, same data as for holotype. The specimens are in the collection of Taiwan Provincial Malaria Research Institute, Nankang, Taipei, Taiwan, Republic of China.

DISTRIBUTION. Known also from Alishan (2400m), Wufeng, Chiai Hsien; Taoyuan, Yenping, Taitung Hsien; Loshui

and Shungloshan, Ilan Hsien, Taiwan.

BIOLOGY. The larvae were found breeding in ground pools, rock pools, and artificial containers in association with *Culiseta lishanensis* and *Culex sasai* (a mosquito new to Taiwan). They can survive under ice. The habits of adults are unknown.

SYSTEMATICS. The mosquito, in most respects, shows a close resemblance to *Aedes pulchritus* and is therefore described here as a new subspecies of that species. It differs from type species chiefly as follows: No golden scales present on clypeus and palpi; *pbn* without narrow golden scales; complete silvery bands present only on tergites II-V in male and II-III in females; forefemur with a short thin line of pale scales anteriorly and a broad stripe of pale scales posteriorly. The male terminalia is almost indistinguishable from that of type species.

AEDES (FINLAYA) AUREOSTRIATUS TAIWANUS, N. SSP.

MALE. Head. Proboscis dark; palpus all dark, about three-fourths as long as proboscis, last segment about as long as its apical bristles; torus pale brown, not scaled; antenna plumose, flagellum dark; vertex with a median longitudinal area of narrow yellow scales, an anterior submedian area of broad dark scales, and an entire lateral area of broad white scales; nape with a band of yellow upright-forked scales. Thorax. Mesonotum with distinct lines of golden scales arranged as follows: A longitudinal median line forking posteriorly before prescutellar space, a submedian anterior line, a line around anterior margin of mesonotum bowing

inward along fossal area and continuing to posterior margin as a sublateral line, and a line or area along lateral margin before the wing base. Scutellum with narrow yellow scales on all lobes, some broadened dark scales enclosing yellow scales on midlobe. *Apn* with broad pale scales; *pbn* with narrow yellow scales on upper aspect, and broadened pale scales on ventro-posterior aspect. A patch of broad white scales present on the following areas: propleural, sudspiracular, prealar, upper sternopleural, medio-posterior sternopleural and mesepimeral; paratergite bare. Wings dorsally dark-scaled, scales narrow; wing

length about 3 mm; haltere knob with dark and dull pale scales; fore- and midfemora anteriorly dark, a small basal pale area and a few scattered pale scales along the ventral margin, and a broad pale line on postepior surface; hindfemur pale on basal two-thirds in front, dark along whole length dorsally, pale on basal five-sixths of posterior surface, a small white knee spot on hindfemur; knee spots on other femora indistinct; tibiae mostly dark, a ventral area of pale scaling basally; foretarsus dark; midtarsus dark, with a basal band on I; hindtarsus (Fig. 1, d) with basal bands usually on I-III, sometimes also on IV; apical bands usually on I, sometimes also on II, the bands complete only on I and II at base, V entirely dark. *Abdomen.* Tergites dark-scaled, I with lateral white bands, II-VIII with baso-lateral silvery-white patches, no white scales medially on I-VII, a complete basal band on VIII; sternites with basal silvery bands. *Terminalia* (Fig. 1, i-m). Clasper narrow, with a short spiniform and two small setae; sidepiece with a group of elongate setae apically and a group of short ones basally on tergal surface, a row of about ten setae on basal fourth of tergomesal margin, and a row of long setae on apical three-fourths of sternomesal margin; claspette filament twisted and broadened apically; claspette stem with three small setae subapically and a small setae subbasally; tergally attached to the base of the claspette is a slender elongate detached lobe carrying a curved line of 4-6 blade-like scales and 5-6 setae; proctiger simple with a well-sclerotized paraproct spine and two cercal setae on each lobe; phallosome

tube-like, simple; ninth tergite with 5-6 setae on each lobe; ninth sternite with 5-6 setae.

FEMALE (Fig. 1, c, e). Agreeing with male in general, differing only as follows: Palpus about one-fifth as long as proboscis, dark; antenna much less plumose; submedian dark area on vertex much more extensive, lateral white area enclosing a small dark area nearby submedian one; wing length about 3.5 mm; hindtarsus with basal bands on I-IV and apical bands on II and III, bands complete only on I and II; tergites II-VII with baso-lateral silvery-white patches, no white scales medially on tergites I-VIII.

PUPA (as Fig. 7, g-h).

LARVA (Fig. 7, a-f). *Head.* Antenna slender, basal half sparsely spiculate, with a single hair 1-A near middle, tip of the hair not quite reaching apex of antennal shaft; hairs 1-C very slender, less than length of distance between the hairs; 4-C about on a line with 6-C, internal to base of 5-C, small, slender, 7-8-branched; 5-C slightly posterior and internal to 6-C, with four plumose branches, about half as 6-C; 6-C single and very long, sparsely plumose; 7-C with 8-9 plumose branches; 8-C slender, bifid; 9-C 5-6-branched; 10-C 4-branched; 11-C with 4-5 branches; 12-C 2-4-branched; 13-C 4-branched; 14-C single; 15-C trifid; mentum with 23 teeth; median hairs of mouth brush simple. *Thorax.* Integument glabrous; prothoracic hair O-P with 12 apically furcated branches; 1-3-P arising close together; 1-P trifid; 2-P single; 4-P 4-branched; 4-P trifid; 5-P with three plumose long branches; 6-P single, long; 7-P long, bifid, plumose; 8-P bifid; 9-12-P

arising from a common plate, all single except 11-P which is small, furcated apically; 14-P bifid. *Abdomen.* Integument glabrous; 1-VIII with 2-5 branches; 2-VIII with 4-5 branches; 3-VIII with four plumose branches; 4-VIII bifid; 5-VIII with six branches; comb of about 50 apically fringed teeth in a patch; siphon index three in compressed specimens; no acus; hair 1-S inserted slightly beyond middle of siphon, with four plumose branches; pecten of 26 sharp teeth on basal half of siphon, each with a large denticle and some small denticles basad to the large one; anal segment with a two-thirds complete ring which is spiculate allover, spicules along medioposterior border stout, prominent; 1-X single, but apically frayed; 2-X long, 2-4-branched, usually trifid; 3-X long, single; 4-X consisting of ten hairs, all on barred area, each with eight branches; anal gills pointed, unequal, longer pair about as long as anal ring and twice as long as shorter pair.

TYPE SPECIMEN. Holotype, male (78655.15) with larval and pupal skins, *ex* tree-hole, Mashihshih (650m), Taiwu, Pingtung Hsien, Taiwan, November 22, 1963, J. C. Lien and S. Y. Lin; allotype, female (78655.5) with larval and pupal skins, same data as for holotype; paratypes, seven males (78655. 1, .2, .4, .6, .7, .11, .16) and ten females (78655. 3, .8,

.9, .10, .12, .13, .14, .17, .18, .19) with corresponding larval and pupal skins, same data as for holotype. The type specimens are in the collection of Taiwan Provincial Malaria Research Institute, Nankang, Taipei, Taiwan.

DISTRIBUTION. Known also from Tahu and Niuputzu, Fanlu, Chiai Hsien; Hoping, Hsiolin, Hualien Hsien; Wuta, Nanao, Ilan Hsien; and Chiahsien, Kao-hsiung Hsien, Taiwan.

BIOLOGY. The larvae were usually found breeding in deep tree-holes and occasionally in bamboo-stumps. When alive it shows characteristic head attachment to abdomen in almost a right angle, resembling that of *Orthopodomyia*. The habits of adults are unknown.

SYSTEMATICS. This differs from *Aedes aureostriatus* in having no white scales medially on tergites and reduced basal and apical pale banding on hind tarsi. It is most closely related to *Aedes okinawanus*, differing from it chiefly as follows: hindtarsus with basal pale banding on I-IV, and apical pale banding on I-II (basal pale banding on I-IV and apical pale banding on I-III in *Aedes okinawanus*). As the male terminalia of this mosquito is almost indistinguishable from that of *Aedes aureostriatus*, it is treated here as a subspecies. *Aedes okinawanus* also should be treated as a subspecies of *Aedes aureostriatus*.

CULEX (NEOCULEX) LINI, N. SP.

MALE. *Head.* Proboscis, palpus, clypeus, torus and antenna all dark; palpus slightly less than one-half as long as proboscis, subapical segment about

twice as long as apical segment, apical segment with some bristles toward apex. Antenna plumose, apical, and subapical flagellar segments subequal in length.

combined length of the remaining segments about three times as long as subapical segment. Vertex with gray to ochreous narrow curved and brown upright-forked scales on broad median area, and pale broad appressed scales laterally. *Thorax*. Mesonotum with bronzy hair-like fine scales, integument brown; scutellum also with bronzy hair-like scales. *Apn*, *pfn*, and pleuron apparently devoid of scales; one lower mesepimeral bristle present. Wings dark-scaled, alula with elongate dark scales along its margin, squama fringed with bristles. Haltere knob dark. Femora all dark except underside of basal half which is indefinitely pale; tibiae and tarsi all uniformly dark. *Abdomen*. Tergites and sternites all uniformly dark *Terminaria* (Fig. 2, a-c). Clasper narrow basally, expanded apically, with a short spiniform, a small seta and two small projections; sidepiece rather broad and short, with four short setae on inner margin below subapical lobe; subapical lobe with nine rods of various shapes, the distal one with comb-like serration, a long bristle just below base of clasper on sternal surface; phallosome lobes strongly bridged, with scattered, outwardly directed teeth toward inner edge; ninth tergite with eight setae on each lobe.

FEMALE. Agreeing with male in general coloration, differing only as follows: Antennal flagellar segments all subequal in length, with sparse flagellar bristles and dense pubescence. Palpus about one-seventh as long as proboscis.

PUPA (as Fig. 8, g-h).

LARVA (Fig. 8, a-f). *Head*. Antenna slender, uniformly brown except for a

narrow dark area at base, about 12.5 times length of its basal diameter, constricted and tufted at apical seven-tenths, with many spicules before tuft and a few beyond tuft; hairs 1-C dark brown, about one-third as long as distance between the hairs; head hair 4-C very fine, single or bifid; 5-C single, very fine; 6-C single or split into two before middle; 7-C with 4-5 plumose branches, about seven-tenths length of antenna; 8, 9-C both bifid; 10-C single; 11-C single, about as long as 5-C; 12-C small, with four branches; 13-C bifid, sparsely plumose; 14-C small, trifid; 15-C small, with six branches; mentum with 17 teeth. *Thorax*. Prothoracic hair O-P small, with about ten branches; 1-3-P arising from a well-sclerotized plate; 1-P single, slender, short; 2,3-P both single, very long; 4-P fine, single, without sclerotized plate; 5-8-P all single, long, arising from a sclerotized plate respectively; 9-12-P arising from a common plate; 9, 10-P slender, single; 11-P small, bifid or trifid; 12-P stout, long, plumose; 14-P small, bifid. *Abdomen*. Integument glabrous; comb of about 40 apically fringed elongate teeth; hair 1-VIII with 4-5 plumose branches; 2,4-VIII both single; 3-VIII with 8-9 plumose long branches; 5-VIII with two sparsely plumose branches; anal segment completely ringed, posterior border smooth; hair 1-X with 3-4 fine branches; 2-X split into two unequal branches, shorter branch very much slenderer and shorter than the other; 3-X single; 4-X consisting of 14 hairs, each with about 2-10 branches; anal gills slender and tapered to a point, about as long as anal ring; siphon with acus, index 7.1 in compressed

specimens; siphon-saddle ratio 4.0; pecten of 8-12 slender long teeth, each with about 20 minute lateral denticles; 1-S consisting of 12 hair tufts arranged in zigzag way along ventro-lateral aspect, each with 3-5 branches, proximal tuft about 1.6 times as long as basal diameter of siphon.

TYPE SPECIMENS. Holotype, male (62249.9) with larval and pupal skins, ex pool on stream-bed, Chulu (800m), Peinan, Taitung Hsien, Taiwan, December 10, 1961, J. C. Lien and L. C. Lu; allotype, female (62249.10) with larval and pupal skins, same data as for holotype; paratypes, 22 males (62249.3, .5, .17, .22, .25, .26, .27, .33, .34, .35, .36, .37, .43, .44, .45, .48, .50, .53, .74, .78, .79, .80) and 57 females (62249.1, .2, .4, .6, .7, .8, .11, .12, .13, .14, .15, .16, .18, .19, .20, .21, .23, .24, .28, .29, .30, .31, .32, .38, .39, .40, .41, .42, .46, .47, .49, .51, .52, .54, .55, .56, .57, .58, .59, .60, .61, .62, .63, .64, .65, .66, .67, .68, .69, .70, .71, .72, .73, .75, .76, .77, .81) with corresponding larval and pupal skins, same data as for holotype. The type specimens are in the collection of Taiwan Provincial Malaria Research Institute, Nankang, Taipei, Taiwan, Republic of China.

DISTRIBUTION. Very widely distributed in mountainous region throughout

Taiwan Proper.

BIOLOGY. The larvae were found breeding in numbers in pools on stream-bed with rocky bottom, very often in association with *Culex fcliatus* (a mosquito new to Taiwan) and rarely with *Anopheles gigas baileyi*, *Anopheles lindesayi* and *Culex vorax*. It rests on surface of water nearly as horizontal as anopheline larvae. The habits of adults are unknown.

SYSTEMATICS. This mosquito is most closely allied to *Culex okinawae* in having the distal rod on subapical lobe of sidepiece serrated and comb-like, however, differs from it in having clasper greatly expanded apically. The female is apparently indistinguishable from that of *Culex okinawae* and *Culex hayashii*. The male is easily distinguished from *Culex hayashii* as well as *Culex okinawae* by the length of palpus. The length of palpus is less than one half of proboscis in *Culex lini*, n. sp. about two-thirds of proboscis in *Culex hayashii*, and slightly more than one half of proboscis in *Culex okinawae*.

REMARKS. This mosquito is named after Mr. H. M. Lin who participated in the field collection and found the mosquito for the first time.

CULEX (LOPHOCERAOMYIA) HUI, N. SP.

Culex (Lophoceraomyia) sp. near *uniformis* Lien, Pacific Insect, 4 (3) : 632, 1962.

MALE (Fig. 2, d-f). *Head.* Vertex with a broad median area of pale narrow curved scales, intermixed with dark upright forked scales; dark narrow

curved scales present on medio-posterior aspect; a patch of broad white appressed scales on each side extending medially as a line along eye margin. Palpus and proboscis dark, proboscis not swollen at middle, about 1.2 times length of forefemur; palpus longer than proboscis

by about length of apical segment or slightly less, without forked process at base; apical segment with only one or two hairs near base, subapical segment with several hairs of different lengths, long segment with several hairs of different lengths at its apex. Torus with a prominence on upper inner aspect, the prominence minutely pilose, appearing pale at its extreme tip. Antennal flagellar segments with tufts of specialized bristles on V-VIII; segment V with 6-7 flattened short bristles; VI with a tuft of six flattened bristles; VII with a tuft of six remarkably curved long flattened bristles and a tuft of eight slightly curved shorter flattened bristles; VIII with a tuft of seven long flattened bristles and ten very short hairs. *Thorax.* Mesonotum and scutellum with narrow curved bronzy scales, scutal integument dark brown, scutellar integument grayish brown; postnotum dark brown, bare; *apn* and *pbn* dark brown, *pbn* with a few narrow bronzy scales; pleura without scales, sternopleuron, propleuron, postspiracular and subspiracular areas brown, remaining area of pleuron pale greenish; one lower mesepimeral bristle present. Wings dark-scaled, scales on costa, subcosta and vein-1 moderately broad, remaining veins with long and narrow scales; forks of vein-2 about 1.9 times as long as its petiole. Haltere knob dark. Legs dark-scaled except underside of hindfemur which is appearing paler. *Abdomen.* Tergites and sternites entirely dark-scaled. *Terminalia* (Fig. 2, d-e). Clasper slightly curved, evenly tapered

to tip, with a short spiniform; sidepiece with a row of six curved long bristles on tergomesal surface; subapical lobe with a broad leaflet, a narrower leaflet, two curved shorter setae, a slender long seta and a prominent group of three rods, two of which have hooked tip, the other with slender curved tip; proctiger with a compact group of bristles at tip; lateral plate of phallosome with the median process curved and pointed, not projecting beyond the apex of dorsal process; dorsal process with a spiculate apical knob and about ten short denticles on lateral margin; ninth tergite with three setae per lobe.

FEMALE. Agreeing with male in general coloration. Palpus and proboscis dark, palpus about one-fifth length of proboscis. Antenna much less plumose than in male, without specialized bristles; torus without a prominence on inner side. Vertex with dark brown narrow scales on a median broad area, these scales intermixed with numerous dark brown upright forked scales and some narrow pale scales; a patch of broad white scales on each side, extending a short distance along eye margin. Legs dark scaled except underside of all femora, basal half of hindfemur on anterior and posterior aspects which are paler; fork of vein-2 about 2.2 times length of its petiole.

PUPA (as Fig. 9, g-h).

LARVA (Fig. 9, a-f). *Head.* Antenna long, tufted and constricted at eight-tenths from base, hair 1-A of about 25 strongly plumose branches, a dark ring at base, apical part beyond hair 1-A slightly darkened, shaft with spicules;

head hairs 1-C fairly stout, pointed, dark, almost straight; 4-C single, slender, about twice as long as 1-C; 5, 6-C with two plumose branches, fairly long, longer than length of antenna; 7-C with seven plumose branches; 8-C small, bifid; 9-C, small, with four branches; 10-C bifid; 11-C with four branches; 12-C small, with five branches; 13-C with five branches; 14-C trifid; 15-C with about seven branches. *Thorax.* Integument with dense fine spicules allover; prothoracic hair O-P small, with eight apically frayed branches; 1, 2-P single, long; 3-P slender, single, shorter than 1, 2-P; 5-8-P arising from separate sclerotized plate; 4, 7-P bifid; 5, 6-8-P single; 9-12-P arising from a common plate; 9, 10-P slender, single; 11-P small, with 2-5 branches; 12-P stout, single, long, plumose; 14-P small, bifid. *Abdomen.* Integument with dense fine spicules allover; eighth abdominal segment with comb of about 46 apically fringed elongate scales, distal scales larger than proximal ones; hair 1-VIII with 5-6 strongly plumose branches; 2, 4-VIII single; 3-VIII with six strongly plumose branches; 5-VIII with three plumose branches; anal segment completely ringed, with minute spicules allover, conspicuous spicules present on latero-posterior border; 1-X with 3-5 slender brancnes; 2, 3-X both single; ventral brush 4-X of 12 hairs, each with 3-7 branches; anal gills subequal, slender, tapered to a point, about twice as long as saddle; siphon index 6.5 in compressed specimens; siphon-saddle ratio 4.0; siphon slightly tapered, with acus, a narrow dark area at base, apex

slightly darkened; pecten of 12 teeth, each with 2-6 lateral denticles; hairs 1-S consisting of four pairs of subventral hair tufts, each with 3-4 branches, most proximal tuft about 1.4 times basal width of siphon, most distal tuft slightly shorter than basal width of siphon; anal rings and siphon strongly sclerotized, appearing brown.

TYPE SPECIMENS. Holotype, male (61864.4) with larval and pupal skins, *ex* bamboo-stump, Chukou, Fanlu, Chiai Hsien, Taiwan, May 14, 1961, J. C. Lien; allotype, female (61864.3) with larval and pupal skins, same data as for holotype; paratypes, one male (61864.2) with pupal skin and one female (61864.5) with larval and pupal skins, same data as for holotype. The type specimens are in the collection of Taiwan Provincial Malaria Research Institute, Nanking, Taipei, Taiwan, Republic of China.

DISTRIBUTION. Known also from Wulai, Taipei Hsien; Chiapaotai, Hoping, Taichung Hsien; Tahu, Fanlu, and Chungho, Chuchi in Chiai Hsien; Kuanyuan, Haituan, Taitung Hsien; Hoping, Hsiolin, Hualien Hsien; Chilanshan, Tatung and Tienshan, Sanhsin in Ilan Hsien.

BIOLOGY. The larvae were found breeding exclusively in bamboo-stumps and tree-holes in mountainous area below 1800 m. The number of larvae per habitat was usually not more than ten. The habits of adults are unknown.

SYSTEMATICS. This mosquito falls in Edwards' (1934) group C (*mammilifer* group) because of having a prominence on inner side of male torus. It is closely related to *Culex uniformis* Theobald,

Culex kuhnsi King and Hoogstraal, *Culex traubi* Colless and *Culex spiculosus* Bram and Rattanarithikul because of pilose larva, but differs from *Culex uniformis* in having the last two segments of male palpus almost hairless instead of "distinctly hairy", different shape of specialized tuft on segment V of male antenna and larval saddle not strongly spinose along distal edge, from *Culex kuhnsi* in having longer palpus of male, different shape of male antenna, and hair 2-X of larva single, from *Culex traubi* in having median process of lateral plate of phallosome not projecting beyond

ond apex of dorsal process, subventral tufts of larval siphon finely pectinate and hair 2-X of larva single, and from *Culex spiculosus* in having a specialized hair tuft on flagellar segment V and larval saddle with a group of spicules on latero-posterior border instead of "medio-posterior border."

REMARKS. This mosquito is named in honor of Dr. Stephen M. K. Hu, head of the Entomology Department in 1958, U. S. Naval Medical Research Unit No. 2, Taipei, Taiwan, Republic of China, for his encouragement and advice.

CULEX (CULEX) NEOVISHNUI, N. SP.

Culex (Culex) vishnui Bohart and Ingram, U. S. Navy, Navmed 1-55, Wash., D. C., p. 83, 1946, Lien, Pacific Insect, 4 (3) : 636, 1962. *nec* Theobald, Mon. Cul. 1 : 355, 1901.

Culex vishnui La Casse and Yamaguti, Mosquito fauna of Japan and Korea, p. 236, 1950, *nec* Theobald, Mon. Cul. 1 : 355, 1901.

Culex (Culex) pseudovishnui Bram, Contributions of the Amer. Ent. Inst. 2 (1) : 222, 1967 (in part), *nec* Colless, Ann. trop. Med. Parasit. 51 : 88, 1957.

MALE. Head. Vertex with narrow pale scales on a large median and supramedian area, a patch of broad white scales laterally enclosing some dark brown broad scales; about eight upright-forked pale yellow scales on median area and numerous upright-forked dark scales on submedian area; palpus with one narrow and one broad pale ring on long segment; narrow basal rings to last two

segments and a narrow apical ring to last segment; proboscis dark, somewhat swollen on apical half, a pale ring present slightly beyond middle; some dark short hairs present basad to pale ring on underside; clypeus, torus and antenna dark; antenna plumose. Thorax. Mesonotum covered with dark brown narrow scales; pale yellow narrow scales present on anterior and lateral margins, prescutellar area, area above wing base and scutellum; *apn* and *ppn* with narrow dark brown scales; 5-7 posterior pronotals; 5-7 propleurals; 11-15 sternopleurals; 4-5 upper mesepimerals; upper aspect of sternopleuron, medio-posterior aspect of sternopleuron and anterior aspect of meseppimeron each with a patch of broadened white scales; propleuron and upper meseppimeron with only 2-5 white scales; wing length 3 mm; wings dark-scaled, with or without pale scales on the posterior margin of costa near humeral cross-vein;

plume scales narrow; base of *af* a little distal to base of *pf*; *af*-petiole index 0.45; haltere knob pale-scaled; legs brownish-black marked with pale scaling; all femora pale at base and apex; forefemur with pale longitudinal stripe along posterior margin, from base almost to apex; midfemur with a broad pale area over basal four-fifths of its posterior surface, hindfemur with broad pale stripes on anterior and posterior surfaces for about basal four-fifths, dorsal and subapical surface dark, pale scaling and dark scaling on external surface fairly sharply contrasted; tibiae all narrowly pale at their bases and apices, with well-defined pale stripe posteriorly on mid- and hind-tibiae; tarsi of all legs with narrow pale bands on segments 1-5, and those on segments 3-5 indistinct.

Abdomen. Tergite I with a patch of darkscales at the centre; tergite II with a central basal patch of pale scales; tergites III-VIII with a narrow basal band of white scales; sternites V-VII with broad basal pale bands. *Terminalia* (Fig. 2, g-h). Clasper curved inward and narrowed apically, with one tiny seta each on external and internal surfaces, and with a finely serrate external margin on the narrowed apical portion; sidepiece with subapical lobe carrying a group of three long flattened processes, two of them with hooked tips, the other a little shorter and thicker, with less hooked apex; distal to these and shorter than them, a group of three flattened processes of graded lengths, two of them with sharply pointed apices, the other with rounded apex; externally, toward the base of the lobe, a

prominent asymmetrical leaf-like process and a hair; lateral plate of phallosome with subequal external and subexternal processes; median process with three or four pointed recurved teeth, and one short, blunt, and more or less straight tooth; ventral cornu with toothed apical margin and not very clearly separated from the median process; a strongly pilose area present on inner surface, basal to the ventral cornu; paraproct with well-developed basal lateral arms and two cercal setae; ninth sternite with 4-5 setae on each weakly developed lobe.

FEMALE. Differing from male as follows: Proboscis black, with a well-defined median creamy ring, no dark hairs medially on underside; palpus short, about one-sixth of proboscis, narrowly pale apically; torus occasionally with some pale scales on inner side; antenna much less plumose; pale upright-forked scales more numerous than in male, around 20 scales; sternites largely pale.

PUPA (as Fig. 10, h-i).

LARVA (Fig. 10, a-g). *Head.* Antenna constricted and tufted at basal two-thirds, shaft with slender spicules, hair 1-A with about 20 plumose branches; 2, 3-A inserted at three-fourths from insertion of hair 1-A; shaft dark on apical third beyond insertion of hair 1-A and a small area just before insertion of hair 1-A; head hair 1-C stout, sharp and black; 4-C small, slightly anterior to 6-C, single or trifid; 5-C with three plumose branches; 6-C with two plumose branches; 7-C with 6-8 plumose branches; 8-C small, with five branches; 9-C small, with 5-6 branches; 10-C single;

11-C bifid; 12-C small, with 3-4 branches; 13-C stout, with two plumose branches; 14-C slender, single; 15-C with 3-5 branches; mentum with 13 regular teeth. *Thorax.* Integument glabrous; prothoracic hair O-P with about 15 branches; 1-3-P arising close together on a sclerotized plate, all long, simple, plumose; 4-6-P arising from separate plate, all plumose; 4-P usually bifid, rarely single; 5, 6-P single; 7-P with three long plumose branches; 8-P with two long plumose branches; 9-12-P arising from a sclerotized plate; 9, 10-P slender, single; 11-P small, with about seven branches; 12-P stout, long, single, plumose; 14-P single, black. *Abdomen.* Integument sparsely spiculate on segment VII basad to the comb, otherwise glabrous; hair 1-VIII with 5-6 plumose branches; 2, 4-VIII both single; 3-VIII with 6-8 plumose branches; 5-VIII with 6-7 plumose branches; comb of 6-15 (5-20 in other series of specimens from type locality) fringed and apically spined teeth with short basal attachment; when the number of teeth are rather numerous a few more proximal teeth are usually small, apically fringed and scale-like; siphon index 3.9-5.6 (average 4.7) in compressed specimens; siphon-saddle ratio 3.2-3.8 (average 3.4); acus present; hairs 1-S consisting of 10-14 (usually 12) hair tufts in an irregular ventral row on apical two-thirds of siphon tube plus two hair tufts lateral in position, each with 4-5 stiff branches; pecten of 8-11 slender sharp teeth, each with about ten lateral denticles; anal segment with a completely sclerotized ring which is inconspicuously spiculate, spicules more

prominent toward posterior margin of ring; hair 1-X slender, with 4-6 branches; 2-X long, with three unequal branches; 3-X long, single; 4-X consisting of 12 hair tufts, each with 4-8 long branches; anal gills pointed, subequal, about twice as long as anal ring.

TYPE SPECIMENS. Holotype, male (CU-30.6) with larval and pupal skins, progeny reared from an egg-raft laid by a female caught when biting a man at night in the woods, Peiyuan, Tungho, Taitung, Taiwan, June 8-9, 1967, J. C. Lien, W. L. Cheng and R. S. Lin; allotype, female (CU-30.1) with larval and pupal skins, same data as for holotype; paratypes, 17 males (CU-30.2, .4, .5, .7, .8, .9, .10, .11, .14, .16, .17, .22, .24, .26, .27, .29, .30) and 14 females (CU-30.3, .12, .13, .15, .18, .19, .20, .21, .23, .25, .28, .31, .32, .33) with corresponding larval and pupal skins, same data as for holotype. The specimens are in the collection of Taiwan Provincial Malaria Research Institute, Nankang, Taipei, Taiwan, Republic of China.

DISTRIBUTION. Widely distributed in foot-hill region throughout Taiwan Proper.

BIOLOGY. The larvae breed in ground pools, ponds and ricefields. The observation made in the type locality indicates that this mosquito is a vicious human biter throughout the night.

SYSTEMATICS. This mosquito is a member of *Culex vishnui* group and has been referred to, in part, as *Culex vishnui* and, in part, as *Culex pseudovishnui* by some workers. Colless (1957) pointed out that the description of *Culex vishnui* by La Casse and Yamaguti (1950)

Table 1. Comparison of the chaetotaxy of fourth instar larvae of *Culex neovishnui* (Taiwan and Japan) and *Culex pseudovishnui*.

Av. no.	Taiwan				Japan				Singapore			
	4-P	Comb	VH	LH	4-P	Comb	VH	LH	4-P	Comb	VH	LH
1	2	—	—	35	1	—	—	5	—	—	—	—
1.5	3	—	—	—	—	—	—	—	—	—	—	1
2	30	—	—	—	4	—	—	—	5	—	—	23
2.5	—	—	—	—	—	—	—	—	—	—	—	1
3	—	—	—	—	—	—	—	—	2	—	—	—
3.5	—	—	—	—	—	—	—	—	1	—	—	—
4.5	—	—	—	—	—	—	—	—	4	—	—	—
5	—	—	1	—	—	—	1	—	1	—	4	—
5.5	—	—	8	—	—	1	1	—	2	—	7	—
6	—	—	21	—	—	—	3	—	1	1	6	—
6.5	—	1	2	—	—	—	—	—	1	—	7	—
7	—	4	3	—	—	3	—	—	—	3	1	—
7.5	—	3	—	—	—	—	—	—	3	8	—	—
8	—	4	—	—	—	—	—	—	—	4	—	—
8.5	—	2	—	—	—	—	—	—	1	3	—	—
9	—	4	—	—	—	—	—	—	—	1	—	—
9.5	—	3	—	—	—	—	—	—	—	2	—	—
10	—	3	—	—	—	—	—	—	—	1	—	—
10.5	—	3	—	—	—	—	—	—	—	—	—	—
11	—	4	—	—	—	—	—	—	1	1	—	—
11.5	—	2	—	—	—	—	—	—	—	—	—	—
12	—	—	—	—	—	—	—	—	1	—	—	—
12.5	—	1	—	—	—	—	—	—	—	—	—	—
13	—	1	—	—	—	—	—	—	—	—	—	—
14	—	—	—	—	—	—	—	—	—	1	—	—
15	—	—	—	—	—	1	—	—	1	—	—	—
Range	1-2	6-15	5-7	1	1-2	4-16	5-6	1	2-16	6-15	5-7	1-3

Abbreviations: Av. no., average number of branches or teeth for individual specimen; VH, siphonal hair tufts ventral in position; LH, siphonal hair tufts lateral in position; Taiwan, *Culex neovishnui* of the type series; Japan, *Culex neovishnui* of Unzen, Nagasaki, Japan; Singapore, *Culex pseudovishnui* of Singapore; number in each column, the number of specimens; Range, the range of number of branches or teeth.

appears to refer, in part or whole, to some other form than *C. pseudovishnui*. Although the adults are not easily separable from *Culex pseudovishnui* (Fig. 2, i, j), the larvae are morphologically distinct. In this species the prothoracic hairs 4-P are usually bifid, rarely single, and only one pair of siphonal

hair tufts are lateral in position, while in *Culex pseudovishnui* (Fig. 10, j) hairs 4-P are usually multiple-branched, rarely bifid, and two pairs of siphonal hair tufts are lateral in position. The result of comparison of larval chaetotaxy is shown in the Tables 1 and 2. It is noteworthy that among the known species

Table 2. Comparison of the chaetotaxy of third instar larvae of *Culex neovishnui* (Taiwan and Japan) and *Culex pseudovishnui*.

Av. no.	Taiwan				Japan				Singapore			
	4-P	Comb	VH	LH	4-P	Comb	VH	LH	4-P	Comb	VH	LH
1	54	—	—	54	3	—	—	3	—	—	—	—
2	—	—	—	—	—	—	—	—	—	—	—	5
3	—	—	—	—	—	—	—	—	1	—	—	—
3.5	—	—	—	—	—	—	—	—	1	—	—	—
4	—	—	—	—	—	—	—	—	1	—	—	—
5	—	—	2	—	—	—	1	—	—	—	—	—
5.5	—	—	9	—	—	1	—	—	—	1	1	—
6	—	—	28	—	—	—	2	—	1	—	4	—
6.5	—	1	12	—	—	—	—	—	—	1	—	—
7	—	3	3	—	—	1	—	—	—	—	—	—
7.5	—	9	—	—	—	—	—	—	—	2	—	—
8	—	7	—	—	—	1	—	—	1	1	—	—
8.5	—	6	—	—	—	—	—	—	—	—	—	—
9	—	3	—	—	—	—	—	—	—	—	—	—
9.5	—	3	—	—	—	—	—	—	—	—	—	—
10	—	6	—	—	—	—	—	—	—	—	—	—
10.5	—	4	—	—	—	—	—	—	—	—	—	—
11	—	4	—	—	—	—	—	—	—	—	—	—
11.5	—	3	—	—	—	—	—	—	—	—	—	—
13	—	1	—	—	—	—	—	—	—	—	—	—
14.5	—	1	—	—	—	—	—	—	—	—	—	—
15	—	1	—	—	—	—	—	—	—	—	—	—
15.5	—	2	—	—	—	—	—	—	—	—	—	—
Range	1	6-18	5-7	1	1	5-8	5-6	1	1-9	5-8	5-6	2

Abbreviations : Taiwan, *Culex neovishnui* of the type locality; others, as for Table 1.

in the *Culex vishnui* group, only the larvae of *Culex pseudovishnui* have multiple-branched hair 4-P and two pairs of siphonal hair tufts lateral in position.

The larval specimens of *Culex neovishnui* from various localities show a considerable range of variation in siphon length, however, they are considered to be conspecific. The following measurements were made from mounted larval skins except those of Japanese specimens which were made from mounted whole larvae. Siphon index: 3.9-5.6

(average 4.7) in 35 specimens of the type series; 4.3-5.7 (average 4.8) in 20 specimens from Nankang Taipei, Taiwan; 5.2-6.5 (average 5.7) in 10 specimens from Sanchien, Changpin, Taitung Hsien, Taiwan; and 6.1-8.5 (average 7.5) in 5 specimens from Unzen, Nagasaki, Japan. Siphon-saddle ratio: 3.2-3.8 (average 3.4) for the type series; 3.2-3.6 (average 3.4) for Nankang specimens; 3.7-4.6 (average 4) for Sanchien specimens; and 3.9-5 (average 4.6) for Unzen specimens.

CULEX (CULEX) KANGI, N. SP.

MALE (Fig. 4, b). *Head.* Vertex with narrow pale scales on a large median and submedian area and area along eye margins, a patch of broad white scales laterally, upright-forked scales on median area pale brown, those on submedian area dark; palpus with one narrow and one broad pale ring on long segment; narrow basal pale rings to last two segments; apical half of last segment pale on underside; outstanding dark hairs present on last two segments and apical part of long segment; proboscis somewhat swollen on apical half, a pale ring present slightly beyond middle, pale streak present dorsally on proboscis before and beyond pale ring, less prominent pale scales present on apical part of proboscis ventrally beyond pale ring; a tuft of dark hairs present at middle of proboscis ventrally; torus and antenna dark; antenna plumose, about as long as long segment of palpus. *Thorax.* Mesonotum covered with bright brown narrow scales, pale brown narrow scales present on anterior and lateral margins, prescutellar area and area above wing base; *apn*, *p_{pn}*, and scutellum with narrow pale brown scales; 6-7 posterior pronotals; 8-12 propleurals; 11-12 sternopleurals; 7-8 mesepimerals; propleuron, upper aspect of sternopleuron, medio-posterior aspect of sternopleuron, anterior aspect of mesepimeron and upper mesepimeron each with a patch of lanceolate white scales; propleural and upper mesepimeral patches often small, of only a few scales; wings marked with light and dark scales, the

former forming spots as follows: a small pale spot on costa and subcosta at about middle of wing; another larger spot immediately beyond subcosta junction, involving costa and vein-1, and one near tip of wing on costa, vein-1, vein-2.1 and vein-2.2; tip of vein-2.1 dark; vein-3 extensively pale, leaving base and tip dark; a small pale spot sometimes present at bifurcations of vein-2 and vein-4; a pale area at middle third of vein-6; vein-5 and vein-5.2 entirely dark; no fringe spot; alula with narrow dark scales along magin; squama fringed; haltere knob pale-tipped; legs brownish black, marked with pale scaling; femora pale posteriorly and ventrally for nearly whole length from base, and with pale knee-spots; fore- and mid-tibiae striped with pale scaling on outer surface for whole length; hind tibia with similar stripe anteriorly and posteriorly for nearly whole length, first tarsal segment of all legs striped with pale scaling; narrow rings over tibio-tarsal and tarsal joints between segments. *Abdomen.* Tergites brownish black, with basal pale bands, lateral margin of tergites with some pale scales extending posteriorly from basal pale bands. *Terminalia* (Fig. 3, a). Clasper curved inward and narrowed apically, with one tiny seta each on external and internal surfaces; sidepiece with subapical lobe carrying a group of three long flattened processes, two of them with hooked tips, the other a little shorter and thicker, with pointed apex; distal to these and shorter than them, a group of three flattened proce-

sses, two of them with rounded apices, the other with sharply pointed apex; externally, toward base of the lobe, a prominent asymmetrical leaf-like process and a hair; lateral plate of phallosome with short subexternal and long external processes; median process with three straight teeth of graded lengths; paraproct with very poorly developed, small basal lateral arms and two cercal setae; ninth tergite with six setae on each weakly developed lobe.

FEMALE (Fig. 4, a). Differing from male as follows: Proboscis black, with a well-defined median creamy ring, no pale streak on proboscis, no prominent hair tuft at middle on underside of proboscis; palpus short, about one-sixth of proboscis, narrowly pale apically; antenna much less plumose; a small pale spot present at bifurcations of vein-2 and vein-4; vein-2.2 not pale-scaled subapically; vein-5.2 very narrowly white-tipped; broad pale area on basal half of vein-6, leaving a short dark area at base of vein; a fringe spot present at vein-5.2.

PUPA (as Fig. 11, g-h).

LARVA (Fig. 11, a-f). *Head*. Antenna constricted and tufted just beyond middle, shaft with slender spicules, hair 1-A with about 30 plumose branches; 2,3-A inserted at two-thirds from insertion of hair 1-A, shaft dark beyond insertion of hair 1-A; head hair 1-C stout, sharp and black; 4-C small, trifid, slightly anterior to 6-C; 5-C with five plumose branches; 6-C with three plumose branches; 7-C with 6-8 plumose branches; 8-C small, trifid; 9-C small, with 5-6 branches; 10-C slender, bifid; 11-C small, bifid; 12-C small, trifid; 13-C

stout, bifid, much longer than 11-C; 14-C stout, single; 15-C small, bifid or trifid; mentum with 15 regular teeth. *Thorax*. Integument glabrous; prothoracic hair O-P small, with about ten branches; 1-3-P arising close together on a sclerotized plate, all long, single, plumose; 4-6-P arising from separate plates, all long, single, plumose; 7-P with 2-3 long plumose branches; 8-P with two long plumose branches; 9-12-P arising from a common plate; 9, 10-P slender, single; 11-P small, with about seven branches; 12-P stout, long, single, plumose; 14-P small, single. *Abdomen*. Integument sparsely spiculate on segment VIII basad to the comb, otherwise glabrous; hair 1-VIII with five plumose branches; 2,4-VIII single; 3-VIII with 6-7 plumose branches; 5-VIII with three plumose branches; comb of 27-34 fringed and apically spined teeth in a patch; siphon index 4.1-7.5 (average 5.5) in compressed specimens; siphon-saddle ratio 3.6-4.6 (average 4.2); acus present; 1-S consisting of 6-8 (usually seven or eight) hair tufts in an irregular ventral row plus four small, single or bifid hairs lateral in position; each of the ventral hair tufts with 2-5 branches, all slightly shorter than siphon diameter at their insertion; pecten of 14-16 slender denticolated teeth on basal one-third of siphon tube and 1-4 simple strong spines on apical one-third of siphon tube; anal segment with a complete sclerotized ring which is inconspicuously spiculate, spicules more prominent toward posterior border of ring; 1-X slender, bifid; 2-X long, bifid subequal in length; 3-X long, single; 4-X consisting of 13 hairs

on barred area, each with 4-7 long branches; anal gills pointed, dorsal pair 1.3 times as long as anal ring, ventral pair only slightly shorter than dorsal pair.

TYPE SPECIMENS. Holotype, male (76343.1) with larval and pupal skins, ex ground-pool, Chienchi, Hsinchu, Hsinchu Hsien, Taiwan, March 1965, C. C. Kang; allotype, female (76343.2) with larval and pupal skins, same data as for holotype; paratypes, three males (76343.3, .4, .6), four females (76343.5, .7, .8, .9) with corresponding larval and pupal skins, and four pupae with corresponding larval skins. The specimens are in the collection of Taiwan Provincial Malaria Research Institute.

DISTRIBUTION. Known also from Lungshan, Hsinchu, Hsinchu Hsien; Waishuangchi, Shihlin, Yangminshan; and Hsiaching, Shunshan, Taipei, Taiwan.

BIOLOGY. The larvae were found breeding in ground pools and seepage in association with *Culex vagans* (a mosq-

quito new to Taiwan) in March and April. The habits of adults are unknown.

SYSTEMATICS. Although the larva resembles that of paratype female of *Culex jacksoni* (Fig. 11, i) in having short thick spines on apical half of siphon, this mosquito differs from *C. jacksoni* in having poorly developed, almost rudimentary basal lateral arms of male paraproct, and longer larval siphon with two pairs of lateral hair tufts. The basal lateral arms of male paraproct are completely absent in *Culex fuscifuractus* of India, undeveloped or small in *Culex fasyi* of the Philippines, and well developed in *Culex mimeticus* (Fig. 3, c), *Culex jacksoni* and other closely related species. The larvae of *C. fuscifuractus* and *C. fasyi* are unknown. It is almost impossible to separate this mosquito from *Culex mimeticus* (Fig. 4, e-f) and *Culex tsengi*, n. sp. by pale markings on wings.

REMARKS. This mosquito is named in honor of Mr. Chi Chang Kang who collected and reared the mosquito individually.

CULEX (CULEX) TSENGI, N. SP.

MALE (Fig. 4, d). *Head.* Vertex with narrow pale scales on a large median and submedian area, a patch of broad white scales laterally, upright-forked scales on median area pale brown, those on submedian area dark; palpus with one narrow and one broad indistinct pale ring on long segment; narrow basal pale rings to last two segments, last segment narrowly pale apically on underside, some dark hairs present on last two segments and apical part of long segment; proboscis

somewhat swollen on apical half, a pale ring present slightly beyond middle, pale streak present dorsally on proboscis before pale ring, some dark hairs present on proboscis at middle ventrally; torus and antenna dark; antenna plumose, slightly shorter than long segment of palpus. *Thorax.* Mesonotum covered with pale golden narrow scales, pale narrow scales present on lateral margin, prescutellar area and area above wing base; *apn.* *pfn* and scutellum with

narrow pale scales, some pale broad scales present on lower aspect of *apn*; 5-9 posterior pronotals; 3-7 propleurals; 7-8 sternopleurals; 6-7 mesepimerals; propleuron, upper aspect of sternopleuron, medio-posterior aspect of sternopleuron, anterior aspect of mesepimeron and upper mesepimeron each with a patch of lanceolate white scales; propleural and upper mesepimeral patches often small, of only a few scales; wings marked with light and dark scales, the former forming spots as follows: a small pale spot on costa and subcosta at about middle of wing (pale scales on costa reduced to a few scales or none); another larger spot immediately beyond subcosta junction, involving costa and vein-1 and sometimes tip of subcosta, and one near tip of wing on costa, vein-1, vein-2.1 and vein-2.2; tips of vein-2.1 and vein-2.2 dark; vein-3 extensively pale, leaving base and tip dark; a few pale scales present at bifurcations of vein-2 and vein-4; a pale area at middle of vein-5.1, leaving tip narrowly dark; a broad pale area on basal half of vein-6, leaving a short dark area at base; vein-5 and vein-5.2 entirely dark; no fringe spot present; alula with narrow dark scales along margin; squama fringed; haltere pale-tipped; legs brownish black, marked with pale scaling; femora pale posteriorly and ventrally for nearly whole length from base, and with pale knee-spots; fore- and mid-tibiae striped with pale scaling on outer sides for whole length; hindtibia with similar stripe anteriorly for nearly whole length; first tarsal segment on all legs striped with

pale scaling; narrow rings over tibiotarsal and tarsal joints between segments. *Abdomen*. Tergites brownish black, with basal pale bands, lateral margin of tergites with no pale scales extending posteriorly from basal pale bands; sternite brownish black with basal pale bands. *Terminalia* (Fig. 3, b). Clasper curved inward and narrowed apically, with one tiny seta each on external and internal surfaces; sidepiece with subapical lobe carrying a group of three long flattened processes, two of them with hooked tips, the other a little shorter and thicker, with rounded apex; distal to these and shorter than them, a group of three flattened processes of graded lengths, all with sharply pointed apices; externally, toward the base of the lobe, a prominent asymmetrical leaf-like process and a hair; lateral plate of phallosome with two short subexternal processes and one long external process; median process with two straight teeth of about same length; paraproct with very poorly developed, small basal lateral arms and two cercal setae; ninth tergite with 3-4 setae on each weakly developed lobe.

FEMALE (Fig. 4, c). Differing from male as follows: Proboscis black, with a well-defined median creamy ring, no pale streak on proboscis, no prominent hair tuft at middle on underside of proboscis; palpus short, about one-sixth length of proboscis, narrowly pale apically; antenna much less plumose; small pale spots present at bifurcations of vein-2 and vein-4; vein-2.2 not pale-scaled subapically; vein-5.2 very indistinctly pale tipped; a fringe spot present

at vein-5.2.

PUPA (as Fig. 12, g-h).

LARVA (Fig. 12, a-f). *Head.* Antenna constricted and tufted just beyond middle, shaft with slender spicules, hair 1-A with about 30 plumose branches; 2,3-A inserted at three-fourths from insertion of hair 1-A, shaft dark on apical one-fifth; head hair 1-C stout, sharp and black; 4-C small, 4-5-branched, slightly anterior to 6-C; 5-C with four plumose branches; 6-C with three plumose branches; 7-C with seven plumose branches; 8-C, small, trifid; 9-C small, 4-branched; 10-C slender, single; 11-C single or bifid; 12-C small, single or bifid; 13-C stout, single or bifid, sparsely plumose; 14-C small, stout, single; 15-C bifid or trifid; mentum with 15 teeth. *Thorax.* Integument glabrous; prothoracic hair O-P small, with about 15 branches; 1-3-P arising close together on a sclerotized plate, all long, single, plumose; 4-6-P arising from separate plates, all long, single, plumose; 7-P with 3-4 long plumose branches; 8-P with three long plumose branches; 9-12-P arising from a common plate; 9, 10-P slender, single; 11-P small, with about seven branches; 12-P stout, long, single, plumose; 14-P small, single. *Abdomen.* Integument sparsely spiculate on segment VIII basad to the comb, otherwise glabrous; hair 1-VIII with 5-6 plumose branches; 2,4-VIII both single; 3-VIII with six plumose branches; 5-VIII with four plumose branches; comb of around 34 fringed and apically spined teeth in a patch; siphon index 3.7-5.0 (average 4.4) in compressed specimens; siphon-saddle ratio 3.1-4.1 (average 3.7);

acus present; 1-S consisting of 9-11 (usually 10) hair tufts in an irregular ventral row plus two small, 1-3-branched hair tufts lateral in position, each of the ventral hair tufts with 2-7 branches, proximal tuft longer than diameter of tube at base, distal one small and double or triple; pecten of 18-22 small slender teeth on basal two-fifths of siphon tube. 1-2 large simple teeth on each side between second and seventh ventral hair tufts; anal segment with a completely sclerotized ring which is inconspicuously spiculate, spicules more prominent toward posterior border of ring; 1-X slender, with 1-3 banches; 2-X long, bifid, subequal in length; 3-X long, single; 4-X consisting of 12 hairs on barred area, each with 4-5 long branches; anal gills pointed, dorsal pair about twice as long as anal ring, ventral pair slightly shorter than dorsal pair.

TYPE SPECIMENS. Holotype, male (62038.9) with larval and pupal skins, *ex* seepage, Chihtuan (1200 m), Loshui, Tatung, Ilan Hsien, Taiwan, September 9, 1961, C. L. Chung, L. C. Lu; allotype, female (62038.10) with larval and pupal skins, same data as for holotype; paratypes, four males (62038.2, .3, .4, .6) and four females (62038.1, .5, .7, .8) with corresponding larval and pupal skins, same data as for holotype. The specimens are in the collection of Taiwan Provincial Malaria Research Institute, Nankang, Taipei, Taiwan, Republic of China.

DISTRIBUTION. Very widely distributed in mountainous region throughout Taiwan Proper.

BIOLOGY. The larvae were found

most frequently on green algae covered ground pools of dried up streams of river-beds. The larvae of *Culex bitaeniorhynchus* were often found in the same pools. The habits of adults are unknown.

SYSTEMATICS. This mosquito is most closely allied to *Culex kangi* in having poorly developed, almost rudimentary basal lateral arms of male paraproct, however, it differs from it in having median process with only two straight teeth of about same length (three straight teeth of graded lengths in *Culex kangi*), no strong spines on subapical portion of larval siphon, and

ventral hair tufts of larval siphon longer and more in number (9-11 vs. 6-8). It is almost impossible to separate this species from *Culex mimeticus* (Fig. 4, e-f) by pale markings on wings. Although the costa at middle of wing is entirely dark in the type specimens, it is pale in the specimens from other localities on Taiwan.

REMARKS. This mosquito is named in honor of Dr. Po Tsun Tseng, Director of Taiwan Provincial Malaria Research Institute, for his strong support and encouragement.

CULEX (CULEX) NEOMIMULUS, N. SP.

MALE (Fig. 4, h, j). *Head.* Vertex with narrow pale scales on a large median and submedian area, a patch of broad white scales laterally, upright-forked scales on median area pale yellow, those on submedian area dark; palpus with one narrow and one broad pale ring on long segment; a row of pale hairs on underside of apical third of long segment; narrow basal pale rings to last two segmentens, an apical pale ring to last segment; proboscis normal, with a pale ring well beyond middle, no pale streak on proboscis, some dark haies present basad to pale ring on underside; clypeus, torus and antenna dark; antenna plumose, much shorter than long segment of palpus. *Thorax.* Mesonatum covered with yellowish brown narrow scales, pale yellow narrow scales present on prescutellar area and area above wing base; *apn*, *pfn* and scutellum with narrow pale yellow scales; 8-9 posterior

pronotals; 8-9 propleurals; 7-11 sternopleurals; 6-7 mesepimerals; propleuron, upper aspect of sternopleuron, medio-posterior aspect of sternopleuron, anterior aspect of mesepimeron and upper mesepimeron each with a patch of lanceolate white scales; propleural and upper mesepimeral patches often small, of only a few scales; wings marked with light and dark scales, the former forming spots as follows: a small pale spot on costa, subcosta at about middle of wing, extending over vein-1, vein-2 and vein-4, the pale scaling on vein-2 and vein-4 sometimes very much reduced; another larger spot immediately beyond subcosta junction, involving costa and vein-1, and one near tip of wing on costa, vein-1 and vein-2.1; tip of vein-2.1 dark; vein-3 extensively pale, leaving base and tip dark; a few pale scales occasionally present at bifurcations of vein-2 and vein-4; a pale area at middle of vein-5.1,

leaving tip broadly dark, and a broad pale area at middle third of vein-6, a pale area sometimes present on vein-5 at the level of pale area on vein-6, tip of vein-5.2 dark or very narrowly pale; no fringe spot present; alula with narrow dark scales along margin; squama fringed; haltere knob pale tipped; legs brownish black, marked with pale scaling; femora pale posteriorly and ventrally for nearly whole length from base, and with pale knee-spots; fore- and mid-tibiae striped with pale scaling ventrally for whole length; hindtibiae with similar stripe anteriorly and posteriorly for nearly whole length; first tarsal segment on all legs striped with pale scaling; narrow rings over tibio-tarsal and first three tarsal joints on all legs.

Abdomen. Tergites brownish black, with basal pale bands; sternites brownish-black, with basal pale bands.

Terminalia (Fig. 3, d). Clasper curved inward and narrowed apically, with one tiny seta each on external and internal surfaces, and with a finely serrate external margin on the narrowed apical portion; sidepiece with subapical lobe carrying a group of three long flattened processes, two of them with hooked tips, the other a little shorter and thicker, with rounded apex; distal to these and shorter than them, a group of three flattened processes of about same length, two of them with sharply pointed apices, the other with rounded apex; externally, toward the base of the lobe, a prominent asymmetrical leaf-like process and a hair; lateral plate of phallosome with subequal external and subexternal processes; median process with four pointed recurved teeth plus

one or two more or less straight teeth; ventral cornu apically serrate, with external apical margin strongly sclerotized and modified into 2-3 sharply pointed accessory teeth; a strongly pilose area present on inner surface basal to the ventral cornu; paraproct with well-developed basal lateral arms and two cercal setae; ninth tergite with 3-6 setae on each weakly developed lobe.

FEMALE (Fig. 4, g,i). Differing from male as follows: Proboscis black, with a well-defined median creamy ring; palpus shurt, about one-sixth length of proboscis, narrowly pale apically; antenna much less plumose; first pale costal spot involving subcosta, vein-1, vein-2 and vein-4, the pale scaling on vein-2 and vein-4 always very distinct; a fringe spot present at vein-5.2.

PUPA (as Fig. 13, g-h).

LARVA (Fig.13, a-f). *Head.* Antenna constricted and tufted at basal two-thirds, shaft with slender spicules, hair 1-A with about 18 plumose branches; 2,3-A inserted at three-fourths from insertion of hair 1-A, shaft dark beyond insertion of hair 1-A; head hair 1-C stout, sharp and brown; 4-C small, single; 5-C with three plumose branches; 6-C with two plumose branches; 7-C with 6-8 plumose branches; 8-C small, trifid; 9-C small, with 5-6 branches; 10-C slender, bifid or trifid; 11-C bifid; 12-C with four branches; 13-C bifid or trifid, long; 14-C slender, single; 15-C with 3-4 branches; mentum with 15 teeth. *Thorax.* Integument glabrous; prothoracic hair O-P small, with about 12 branches; 1-3-P arising close together on a sclerotized plate, all long, single, plumose; 4-6-P arising from separate pla-

tes, all long, single, plumose; 7-P with three long plumose branches; 8-P with two long plumose branches; 9-12-P arising from a sclerotized plate; 9,10-P slender, single; 11-P small, with 4-5 branches; 12-P stout, long, single, plumose; 14-P single or bifid. *Abdomen.* Integument sparsely spiculate on segment VIII basad to the comb, otherwise glabrous; hair 1-VIII with 4-5 plumose branches; 2, 4-VIII single; 3-VIII with 7-8 plumose branches; 5-VIII with three plumose branches; comb of 34-36 fringed teeth in a patch; siphon index 7.7-9.5 (average 9.2) in compressed specimens; siphon-saddle ratio 5.7-6.7 (average 6.3); acus present; 1-S consisting of 9-12 hair tufts in an irregular ventral row plus two hair tufts lateral in position, each with 1-4 slender branches; pecten of 16 slender teeth on basal fourth of siphon tube, each with 4-6 lateral denticles; anal segment with a completely sclerotized ring which is inconspicuously spiculate, spicules more prominent toward posterior border of ring; 1-X slender, bifid or trifid; 2-X long, with three unequal branches; 3-X long, single; 4-X consisting of 12 hair tufts on barred area, each with 6-8 long branches; anal gills pointed, dorsal pair 3.7 times as long as anal ring, ventral pair only slightly shorter than dorsal pair.

TYPE SPECIMENS. Holotype, male (78788.32) with larval and pupal skins, *ex* ditch, Pinglin, Shuangchi, Taipei Hsien, Taiwan, November 17, 1966, L. C. Lu; allotype, female (78788.1) with larval and pupal skins, same data as for holotype; paratypes, eight males (78788.5, .11, .12, .13, .20, .24, .25, .31) and 22

females (78788.2, .3, .4, .6, .7, .8, .9, .10, .14, .15, .16, .17, .18, .19, .21, .22, .23, .26, .27, .28, .29, .30) with corresponding larval and pupal skins, same data as for holotype. The specimens are in the collection of Taiwan Provincial Malaria Research Institute.

DISTRIBUTION. Widely distributed in foot-hill region throughout Taiwan Proper.

BIOLOGY. The larvae were found breeding in ditches, ground pools, ponds, concrete water tanks in association with *Culex hayashii*, *Culex infantulus* (a mosquito new to Taiwan), *Culex bicornutus*, *Culex pallidothorax*, *Culex vorax* and others in diffent combinations.

SYSTEMATICS. Examination of a series of ten males and ten females (with corresponding larval and pupal skins) resulting from an egg-raft deposited by a female *Culex mimulus* trapped in Perlis, Malaya, July 1964 and by comparison of Malayan material with information provided by Dr. P. F. Mattingly (Personal communication, 12 October 1965) regarding the pale wing markings of type male, the author has concluded the following: that *Culex mimulus* has the first pale costal spot extending only to vein-1 in male (Fig. 4, 1) and to vein-4 with this area of vein-2 dark in female (Fig. 4, k), vein-3 entirely dark in male (Fig. 4, 1) and pale-scaled on a small area at middle in female (Fig. 4, k), and long slender siphon (siphon index 7.8-9, average 8.3; siphon-saddle ratio 5.7-6.8, average 6.2) with 11-12 hair tufts of 1-3 weak branches in larva. A male, a female, and three larvae from Singapore (identified by Dr. D. H. Colless as *Culex*

mimulus), and a series of specimens including males, females and larvae resulting from an egg-raft collected from a ground pool in Peiyuan, Tungho, Taitung Hsien, Taiwan, 9 June 1967, agree very well with the Malayan material in all respects mentioned above. Edwards (1934) in the first half of the sixth couplet of female key to species or variety of *C. mimeticus* group indicates "First pale costal spot not extending beyond vein-1" in *Culex mimulus*. This is obviously an error which has never been pointed out. This finding convinced the author that at least three distinct species have been

erroneously referred to as *Culex mimulus*.

Culex neomimulus, n. sp. is closely related to *Culex mimulus* in having the first costal spot extending to vein-4 in female and long slender siphon with 11-14 hair tufts in larva, but differs chiefly from the latter in having the first costal spot extending to vein-2 including vein-2 in female and sometimes also in male, and vein-3 always extensively pale-scaled except at base and tip in both sexes. The male terminalia seems to differ very slightly from that of *Culex mimulus* (Fig. 3, f).

CULEX (CULEX) MURRELLI, N. SP.

Culex (Culex) mimulus Bram, Contr. Amer. Ento. Inst. 2 (1): 213, 1967, (in part), *nec* Edwards, Bull. ent. Res., 5, 284, 1915.

MALE (Fig. 4, n, p). Head. Vertex with narrow pale yellow scales on a large median area, a patch of broad white scales laterally, enclosing a small patch of dark broad scales; upright-forked scales on median area pale yellow, those on submedian area dark; palpus with two narrow pale rings on long segment; a row of pale hairs on underside of apical third of long segment; narrow basal pale rings to last two segments, an apical pale streak on proboscis, some dark hairs present basad to pale ring on underside; clypeus, torus, and antenna dark; antenna plumose, longer than long segment of palpus. Thorax. Mesonotum largely covered by pale yellow narrow scales, scales on median area dark brown; scutellum with pale yellow narrow scales;

apn with golden narrow scales, *pbn* with pale yellow narrow scales; 5-9 posterior pronotals; 5-8 propleurals; 11-14 sternopleurals; 7-8 upper mesepimerals; propleuron, upper aspect of sternopleuron, medio-posterior aspect of sternopleuron, anterior aspect of mesepimeron each with a patch of lanceolate white scales; propleural and upper mesepimeral patches often small, of only a few scales; wings marked with light and dark scales, the former forming spots as follows: a small pale spot on costa, subcosta at about middle of wing, extending over vein-1; another larger spot immediately beyond subcosta junction, involving costa and vein-1, and one near tip of wing on costa, vein-1 and vein-2.1; tip of vein-2.1 dark; vein-3 extensively pale, leaving base and tip dark; pale scales occasionally present at bifurcation of vein-2; vein-4.1 and vein-4.2 usually dark, sometimes indistinctly pale; a small pale area at middle of

vein-5.1 usually present, sometimes absent; a broad pale area on basal half of vein-6; vein-5 entirely dark; vein-5.2 dark or narrowly pale apically; no fringe spot present; alula with narrow dark scales along margin; squama fringed; haltere knob pale-tipped; legs brownish black, marked with pale scaling; femora pale ventrally for nearly whole length, and pale posteriorly on basal two-thirds of mid- and hind-femora; fore- and mid-tibiae striped with pale scaling on ventral surface for whole length; hindtibiae with similar stripe anteriorly and posteriorly for nearly whole length; first tarsal segment indistinctly striped with pale scaling; narrow pale rings over tibiotarsal and first two tarsal joints on all legs. *Abdomen.* A small patch of dark scales at middle on tergite I, a large patch of pale scales on tergite II medially; narrow basal pale bands on tergites III-VIII, lateral aspect of tergite II-VIII with scattered pale scales; apices of tergites VII and VIII pale-scaled; sternites brownish black, with basal pale bands. *Terminalia* (Fig. 3, e). Clasper curved inward and narrowed apically, with one tiny seta each on external and internal surfaces; sidepiece with subapical lobe carrying a group of three flattened processes, two of them with hooked tips, the other a little shorter and thicker, with rounded apex; distal to these and shorter than them, a group of three flattened processes of about the same length, all with sharply pointed apices; externally, toward the base of the lobe, a prominent asymmetrical leaf-like process and a hair; lateral plate of phallosome with subequal external and subexternal

processes; median process with three pointed recurved teeth plus one more or less straight tooth or none; ventral cornu apically serrate, with external apical margin strongly sclerotized and modified into 2-3 sharply pointed accessory teeth; a strong pilose area present on inner surface, basal to the ventral cornu; paraproct with well-developed basal lateral arms and two cercal setae; ninth tergite with 4-7 setae on each weakly developed lobe.

FEMALE (Fig. 4, m, o). Differing from male as follows: Proboscis black, with a well-defined median creamy ring; palpus short, about one-sixth length of proboscis, narrowly pale apically; antenna much less plumose; vein-5, vein-5.1 and vein-5.2 entirely dark, occasionally with a few pale scales at bifurcation of vein-5; a fringe spot present at vein-5.2.

PUPA (as Fig. 14, g-h).

LARVA (Fig. 14, a-f). *Head.* Antenna constricted and tufted at basal two-thirds, shaft with slender spicules, hair 1-A with about 20 plumose branches; 2, 3-A inserted at three-fourths from insertion of hair 1-A, shaft dark beyond insertion of hair 1-A; head hair 1-C stout, sharp and brown; 4-C small, bifid; 5-C with three plumose branches; 6-C with 3-4 plumose branches; 7-C with 7-9 plumose branches; 8-C small, 4-branched; 9-C small, 4-branched; 10-C small, bifid; 5-C with three plumose branches; 6-C with 3-4 plumose branches; 7-C with 7-9 plumose branches; 8-C small, 4-branched; 9-C small, 4-branched; 10-C small, trifid; 11-C bifid; 12-C trifid; 13-C stout, bifid or trifid; 14-C single or bifid; 15-C 4-branched; mentum with 15 teeth. *Thorax.*

Integument glabrous; prothoracic hair O-P small, with about ten branches; 1-3-P arising close together on a sclerotized plate, all long, single, plumose; 4-6-P arising from separate plates, all long, single, plumose; 7-P with three long plumose branches; 9-12-P arising from a sclerotized plate; 9, 10-P slender, single; 11-P small, with six branches; 12-P stout, long, single, plumose; 14-P single or bifid. *Abdomen.* Integument sparsely spiculate on segment VIII basad to the comb, otherwise glabrous; 1-VIII with four plumose branches; 2,4-VIII single; 3-VIII with seven plumose branches; 5-VII with 3-4 plumose branches; comb of 34-36 fringed teeth in a patch; siphon index 4.9-6.5 (average 6) in compressed specimens; siphon-saddle ratio 4.5-5.2 (average 4.8); acus present; 1-S consisting of 6-8 hair tufts in an irregular ventral row plus two hair tufts lateral in position, each with 1-4 slender branches; pecten of ten broad teeth on basal fourth of siphon tube, each with 5-6 lateral denticles; anal segment with a completely sclerotized ring which is inconspicuously spiculate, spicules more prominent toward posterior border of ring; 1-X slender, bifid or trifid; 2-X long, with two unequal branches; 3-X long, single; 4-X consisting of 12 hair tufts on barred area, each with 6-8 long branches; anal gills pointed, dorsal pair about two times as long as anal ring, ventral pair only slightly shorter than dorsal pair.

TYPE SPECIMENS. Holotype, male (76324.28) with larval and pupal skins, *ex* rock pool, Hsinhsien, Wulai, Taipei Hsien, Taiwan, April 23, 1963, C. L.

Chung; allotype, female (76324.26) with larval and pupal skins, same data as for holotype; paratypes, 27 males (76324. 1, .2, .6, .8, .9, .10, .11, .12, .13, .20, .21, .23, .24, .25, .30, .31, .33, .34, .43, .51, .52, .53, .54, .55, .57, .58, .59), 33 females (76324. 3, .4, .5, .7, .14, .15, .16, .17, .18, .19, .22, .27, .29, .32, .35, .36, .37, .38, .39, .40, .41, .42, .44, .45, .46, .47, .48, .49, .50, .56, .60, .61, .62) with corresponding larval and pupal skins, same data as for holotype. The specimens are in the collection of Taiwan Provincial Malaria Research Institute, Nankang, Taipei, Taiwan, Republic of China.

DISTRIBUTION. Widely distributed in foot-hill region throughout Taiwan Proper. Known also from Thailand (Bram, 1967).

SYSTEMATICS. This mosquito differs from *Culex mimulus* and *Culex neomimulus* in having the first pale costal spot extending only to vein-1 in both sexes, and short, stout siphon with 8-10 hair tufts in larva. The illustrations of *Culex mimulus* by Bram (1967) appear to refer at least in part to this species. His illustrations of pale makings on wing and larva agree very well with the characteristics of this species.

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Taiwan (Diptera: Culicidae). Part II. New species of *Tripteroides*, *Orthopodomyia*, *Culiseta* and *Uranotaenia*. Trop. Med. 10 (1) : 1-20, 1968.

台湾産蚊族の新種(双翅目:蚊科)

第五報 *Aedes* 属の三新亜種と *Culex* 属の七新種

連 日 清

中華民国・台湾省瘧疾研究所

摘要

要

本編では *Aedes* 属の三新亜種と *Culex* 属の七新種の成熟幼虫、蛹及び雌雄成虫に就て記載を行なった。これらはそれぞれ *Aedes* (*Finlaya*) *elsiae vicarius*, n. ssp., *Aedes* (*Finlaya*) *pulchritiventer alius*, n. ssp., *Aedes* (*Finlaya*) *aureostriatus taiwanus*, n. ssp., *Culex* (*Neoculex*) *lini*, n. sp., *Culex* (*Lophoceraomyia*) *hui*, n. sp., *Culex* (*Culex*) *neovishnui*, n. sp., *Culex* (*Culex*) *kangi* n. sp., *Culex* (*Culex*) *tsengi* n. sp., *Culex* (*Culex*) *neomimulus*, n. sp. 及び *Culex* (*Culex*) *murrelli*, n. sp. と命名された。これらはいずれも台湾本島の山脚地帯で採集された。

Aedes elsiiae vicarius, n. ssp. は以下の諸点で type 種と異なる: 成虫の腹節腹面は主として暗褐色 (*elsiae* では主として黄色); *ppm* に幅の広い暗色鱗片斑があり、その暗色斑の上下には白色扁平鱗斑がある (*elsiae* では *ppm* の下縁に黄色狹曲鱗と白色扁平鱗がある); 幼虫の触角毛は二分岐し、触角基部三分の一の部位より生ずる (*elsiae* では三乃至五分岐し、触角の中央部より生ずる); 幼虫の胸部と腹部の被膜は微毛にて被われる (*elsiae* の原記載ではこの点に就いて言及していないので被膜は微毛にて被われていないものと思われる)。

Aedes pulchritiventer alius, n. ssp. は以下の諸点で type 種と異なる: 成虫の額部と触鬚には黃金色鱗がない; *ppm* には黃金色の狹曲鱗がない; 完全な白横帶は雄にては第二乃至第五腹節背板に限られ、雌にては第二乃至第三腹節背板に限られる; 前肢腿節の前方には白色鱗によって形成せる細く且つ短い線紋があ

り、後方に幅の広い線紋がある。

Aedes aureostriatus taiwanus, n. ssp. は以下の諸点で type 種と異なる: 成虫腹部背面の各節中央部には白色鱗片がなく、後肢踏節の基部白帯と末端白帯の数が type 種より少ない。この亜種は次の点で *Aedes okinawanus* と異なる: 後肢踏節の末端白帯は第一乃至第二踏節に限られる (*okinawanus* では第一乃至第三踏節に限られる)。

Culex lini, n. sp. は *C. okinawae* に近似するが、以下の諸点で異なる: 雄の把握片は末端が非常に膨大し、雄の触鬚の長さは吻の二分の一以下である (*okinawae* では吻の二分の一より稍長い)。

Culex hui, n. sp. は幼虫の胸部と腹部の被膜が微毛にて被われる点で *C. uniformis*, *C. kuhnsi*, *C. traubi* と *C. spiculosus* とに近似するが、以下の諸点で異なる: 雄の触鬚末端二節は殆んど毛がなく、雄の触角第五節の特殊の毛房の形状と幼虫尾節鞍板後縁に強棘がない点で *C. uniformis* と異なる。雄の触鬚の長さ、雄の触角の特殊の毛房の形状と幼虫尾節の二号毛が単条である点で *C. kuhnsi* と異なる。Phallosome の median process は dorsal process より突出せず、幼虫の呼吸管毛に細枝があり、尾節の二号毛が単条である点で *C. traubi* と異なる。雄の触角第五節に特殊の毛房があり、幼虫の鞍板の微棘は後側縁に限られる (*spiculosus* ではこれが後央縁に限られる) 点で *C. spiculosus* と異なる。

Culex neovishnui, n. sp. は *C. pseudovishnui* に近似するが、幼虫の前胸四号毛の分岐数と呼吸管の

側毛の数で異なる。前者では前胸四号毛は通常二分岐し、稀に单条であり、呼吸管の側毛は一対のみであるが、後者では四号毛は通常多数に分岐し、稀に二分岐する、呼吸管の側毛は二対である。

Culex, kangi, n. sp. は幼虫の呼吸管末端の近くに強棘がある点で *C. jacksoni* の paratype 雌の幼虫のそれに酷似するが、雄の第十節腹板の basal lateral arms は退化し、微小である点で *Culex mimeticus* と *C. jacksoni* 等と異なる。*C. fasyi* と *C. fuscifurcatus* は basal lateral arms が発達していない。それらの幼虫は尚未知である。

Culex tsengi, n. sp. は雄の第十節腹板の basal lateral arms が発達していない点で *Culex kangi*, n. sp. に近似するが、phallosome の median process は二本の同長な直歯を持ち (*Culex kangi*, n. sp. では三本の不同長な直歯を持つ)、幼虫の呼吸管の末端近くに強棘を持たない点等で *Culex kangi*, n.

sp. と異なる。

Culex neomimulus, n. sp. は翅の前縁脈上の第一白斑が雌では第四脈までに及び、幼虫の呼吸管は細長く、11乃至14本の呼吸管毛を持つ点で *C. mimulus* に近似するが、前縁脈上の第一白斑は雌では常に、雄では時に第二脈を含む (*C. mimulus* ではこれを含まない)、第三脈は雌雄共に基部と末端を除いては大部分が白色 (*C. mimulus* の雄はこれが全部黒色、雌はその中央の一小部位のみ白色) である点で *C. mimulus* と異なる。

Culex murrelli, n. sp. は雌雄共に翅の前縁脈の第一白斑が第一脈迄に及び、幼虫の呼吸管は太く且つ短く、8乃至10本の呼吸管毛を持つ点で *C. mimulus* 及び *Culex neomimulus*, n. sp. と異なる。Bram (1967) による泰国産の *C. mimulus* の雌の翅と幼虫の形態図示はこの種の特徴をよく示しているのでこの種は泰国にも産するものと思われる。

Fig. 1

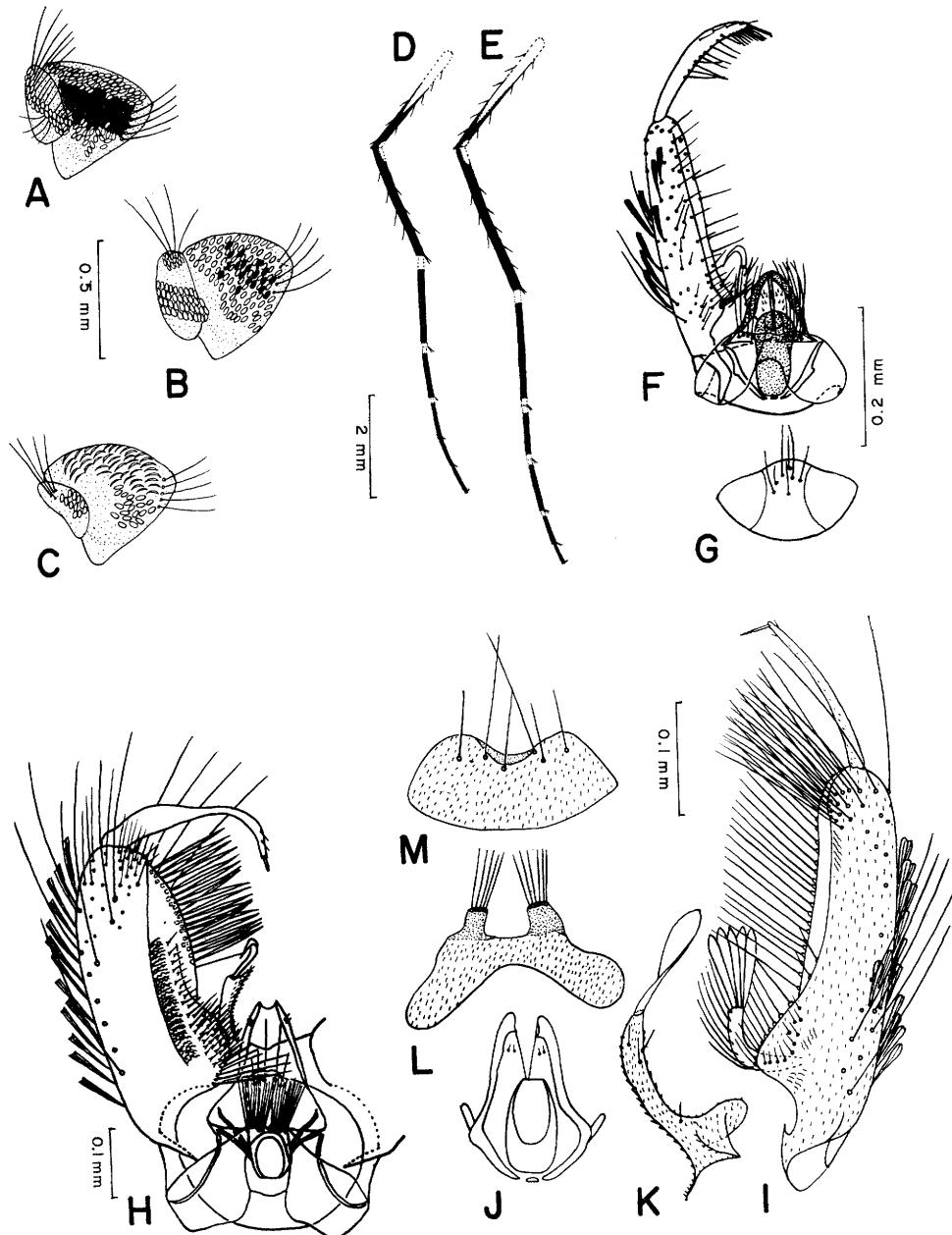


Fig. 1. A-C, apn and ppn of females; A, *Aedes elisiae vicarius*, n. ssp.; B, *Aedes pulchriventer alius*, n. ssp.; C, *Aedes aureostriatus taiwanus*, n. ssp.; D-F, hindlegs of *Aedes aureostriatus taiwanus*, n. ssp.; D, male; E, female; F-G, *Aedes elisiae vicarius*, n. ssp.; F, terminalia; G, ninth sternite; H, terminalia of *Aedes pulchriventer alius*, n. ssp.; I-M, *Aedes aureostriatus taiwanus*, n. ssp.; I, sidepiece; J, proctiger and phallosome; K, claspette; L, ninth tergite; M, ninth sternite.

Fig. 2

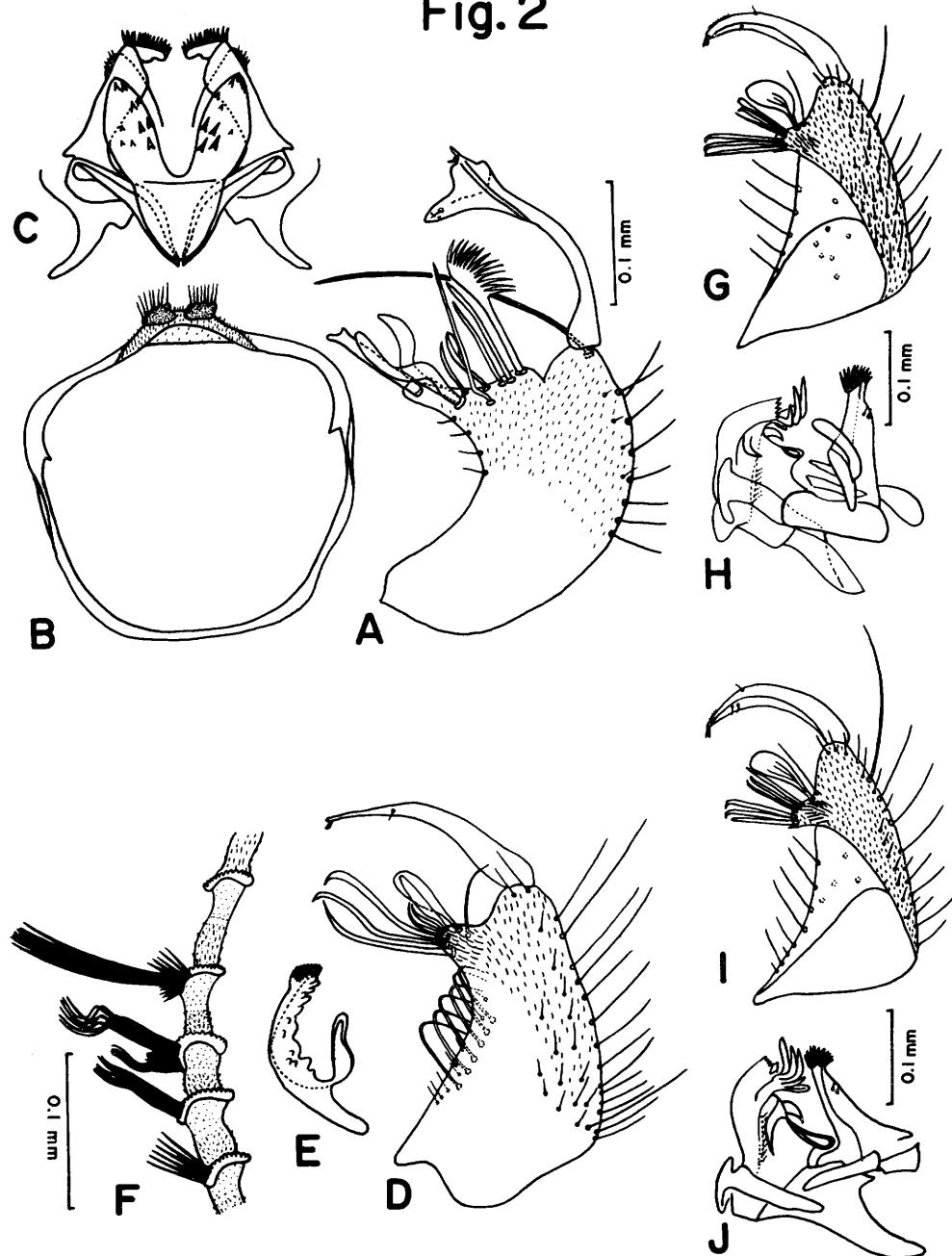


Fig. 2. A-C, *Culex lini*, n. sp.; A, sidepiece; B, ninth tergite and sternite; C, proctiger and phallosome; D-F, *Culex hui*, n. sp.; D, sidepiece; E, half of hallosome; F, male flagellar segments V-IX; G-H *Culex neovishnui*, n. sp.; G, sidepiece; H, phallosome and proctiger; I-J, *Culex pseudovishnui* of Singapore; I, sidepiece; J, phallosome and proctiger.

Fig. 3

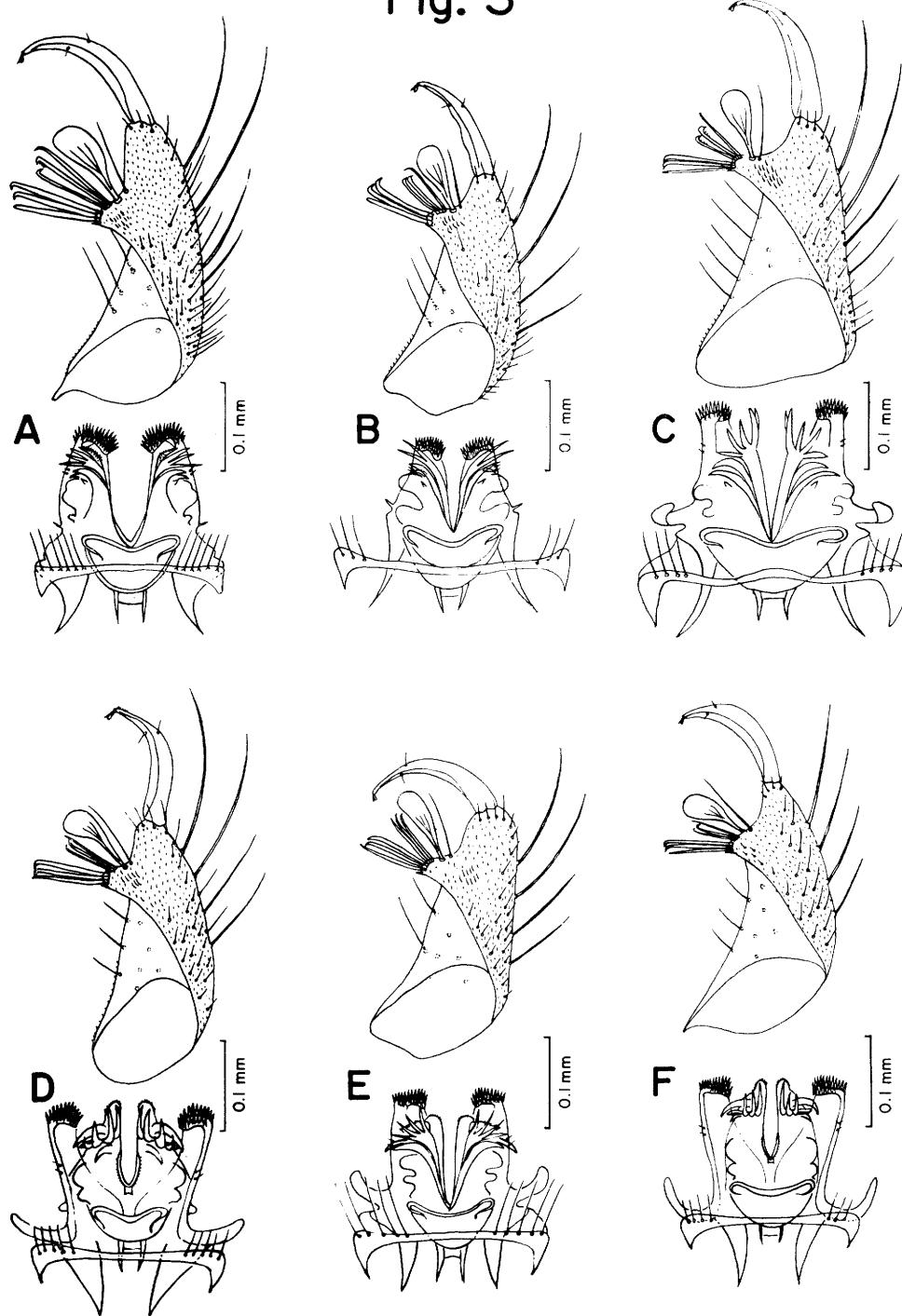


Fig. 3. A-F, sidepiece, phallosome, proctiger and ninth tergite; A, *Culex kangi*, n. sp.; B, *Culex tsengi*, n. sp.; C, *Culex mimeticus* of Taiwan Proper; D, *Culex neomimulus*, n. sp.; E, *Culex murrelli*, n. sp.; F, *Culex mimulus* of Perlis, Malaya.

Fig. 4

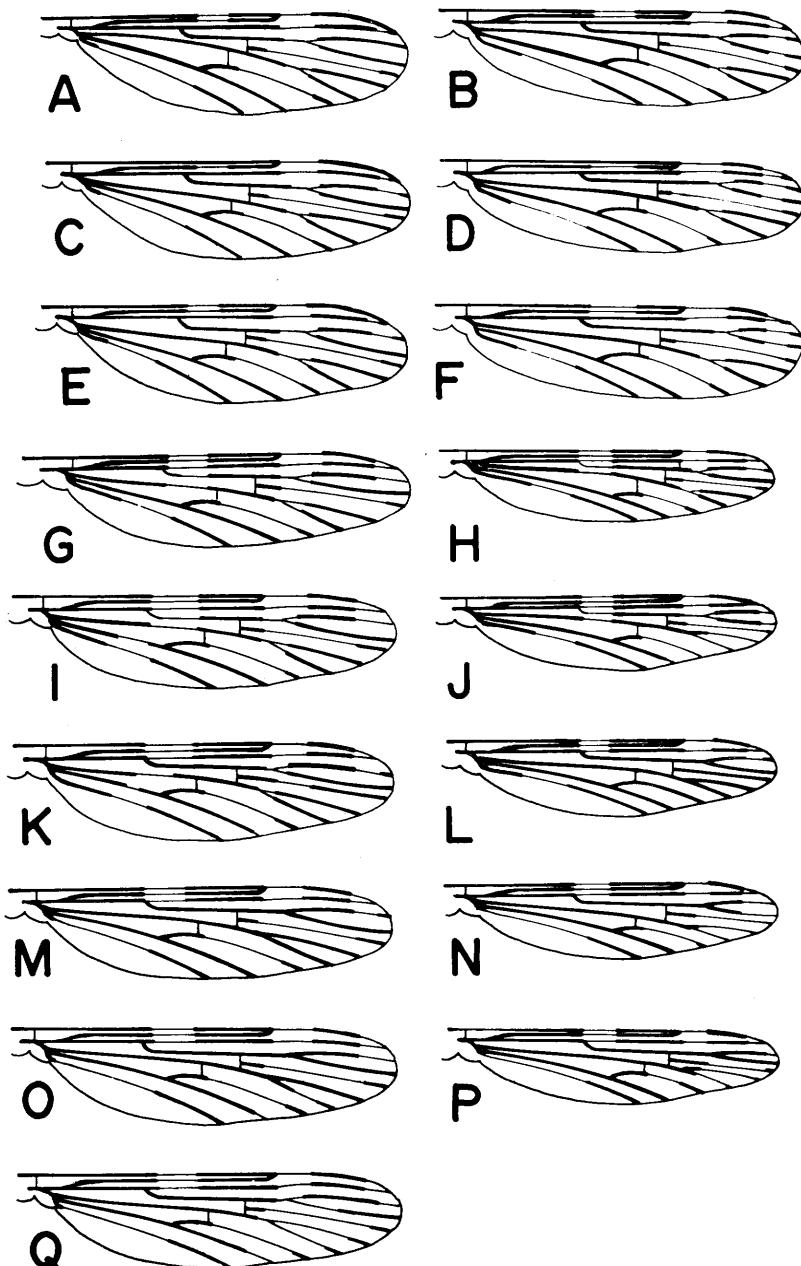


Fig. 4. A, C, E, G, I, K, M, O, Q, female wings; B, D, F, H, J, L, N, P, male wings; A-B, *Culex kangi*, n. sp.; C-D, *Culex tsengi*, n. sp.; E-F, *Culex mimeticus* of Taiwan; G-J, *Culex neomimulus*, n.sp.; K-L, *Culex mimulus* of Perlis, Malaya; M-P, *Culex murrelli*, n. sp.; Q, a variation of *Culex murrelli* from Machukang, Tungshih, Taichung Hsien, Taiwan.

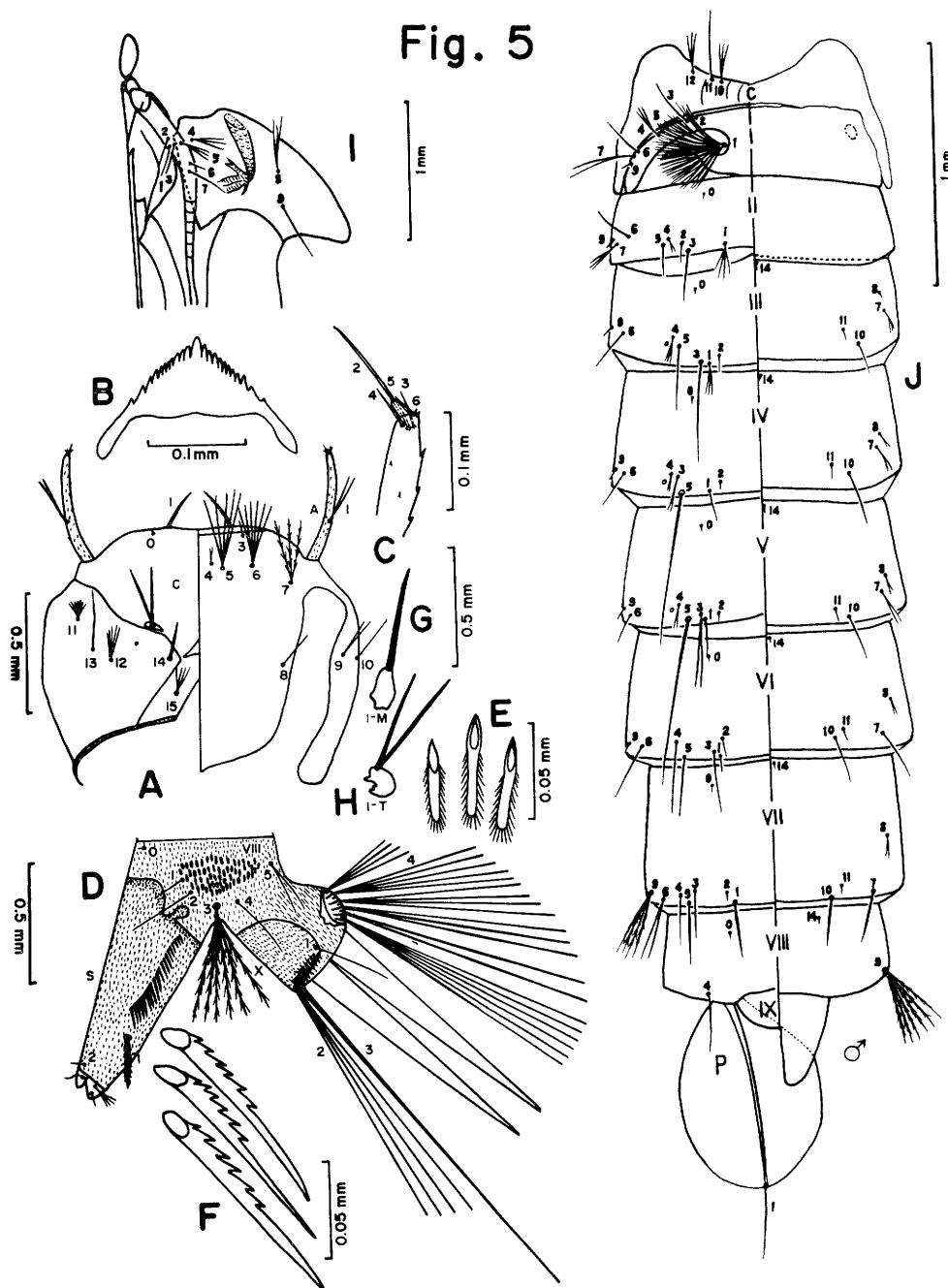


Fig. 5 A-J, *Aedes eliae vicarius*, n. ssp.; A-H, larva; A, head; B, mentum; C, tip of antenna; D, terminal segments; E, comb scales; F, pecten teeth; G, mesothoracic hair l-M; H, metathoracic hair l-T; I-J, pupa; I, cephalothorax; J, metanotum and abdomen.

Fig. 6

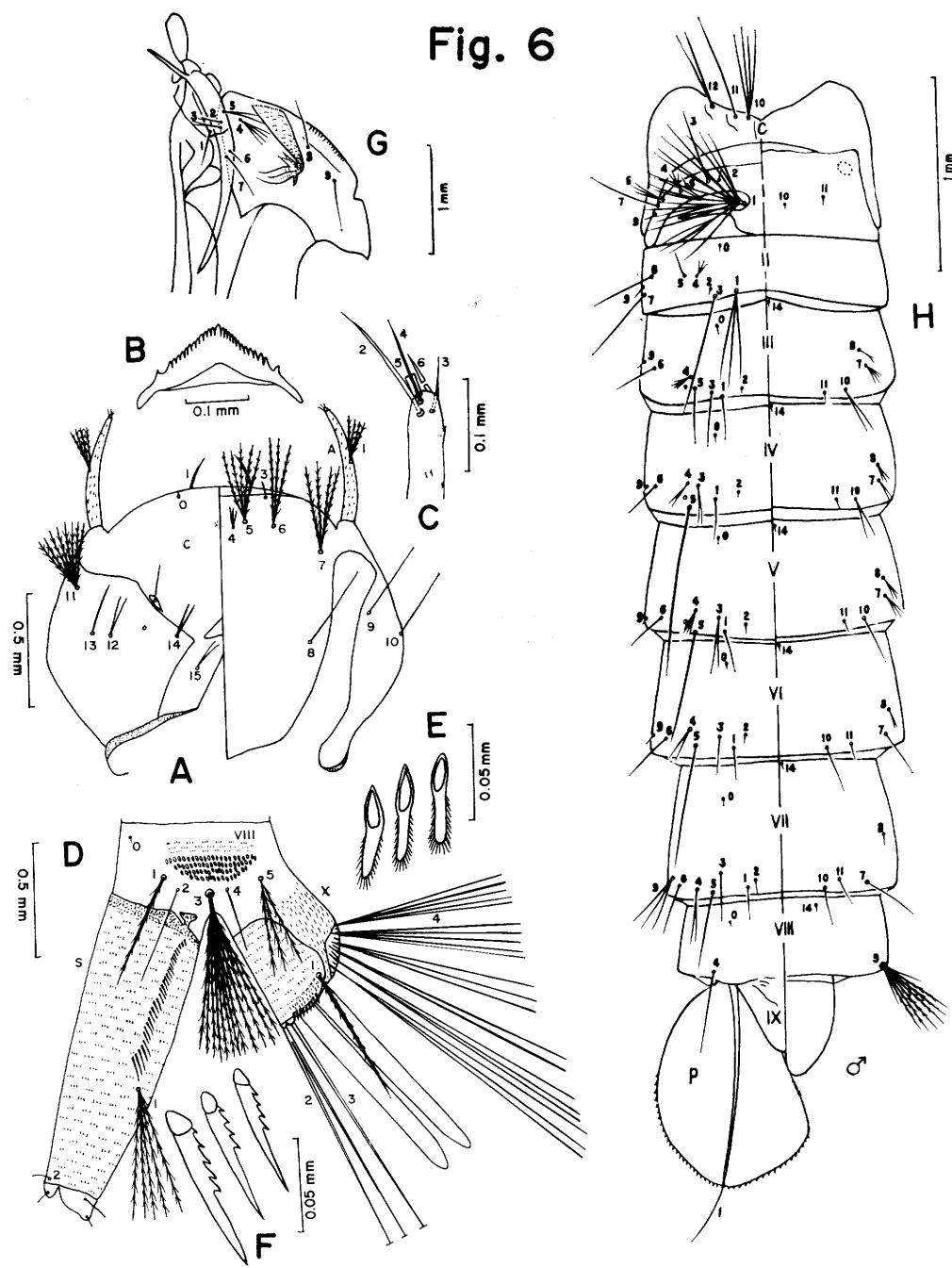


Fig. 6. A-H, *Aedes pulchriventris aliis*, n. ssp.; A-F, larva; A, head; B, mentum; C, tip of antenna; D, terminal segments; E, comb scales; F, pecten teeth; G-H, pupa; G, cephalothorax; H, metanotum and abdomen.

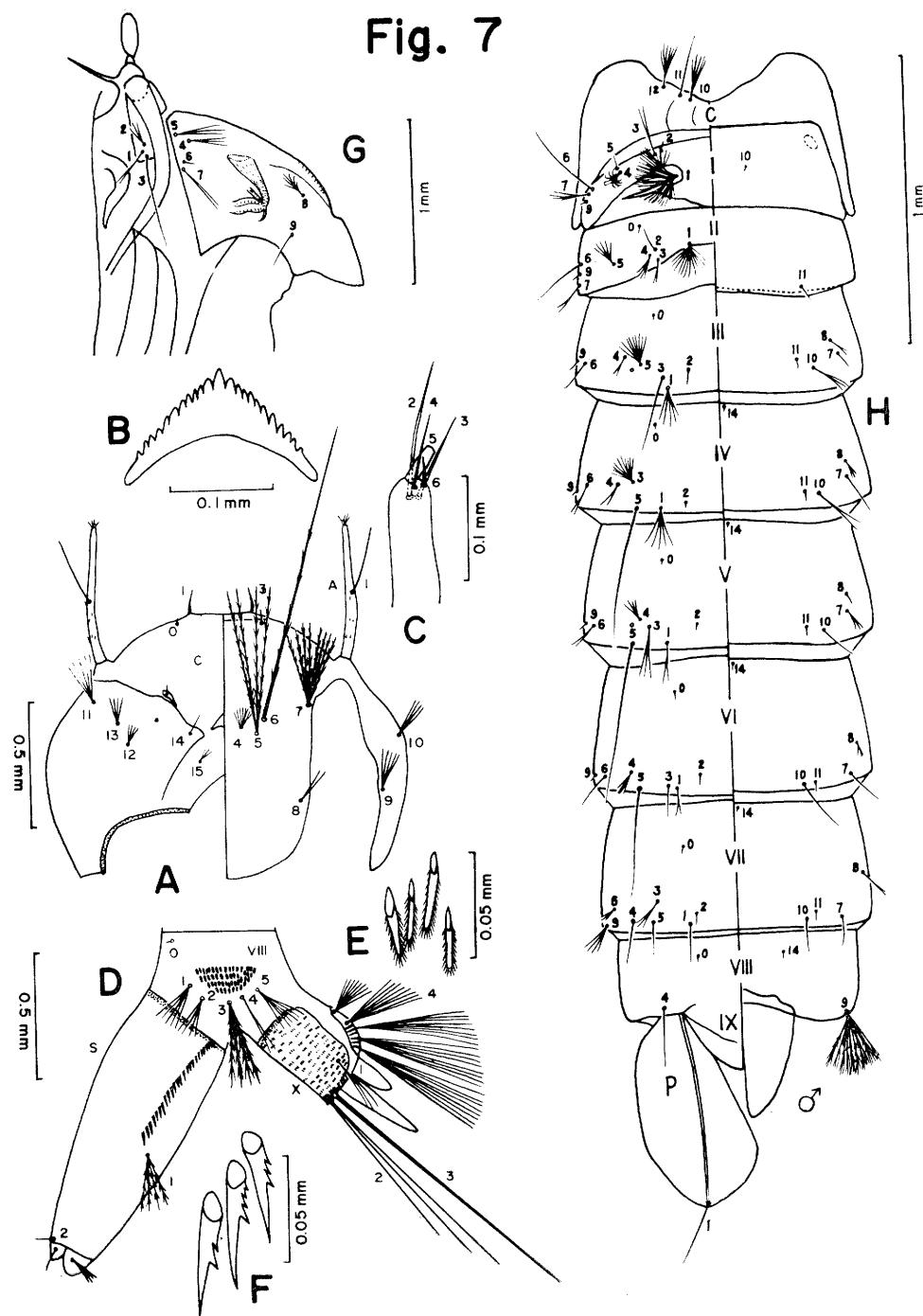


Fig. 7. A-H, *Aedes aureostriatus taiwanus*, n. ssp; A-F, larva; A, head; B, mentum; C, tip of antenna; D, terminal segments; E, comb scales; F, pecten teeth; G-H, pupa; G, cephalothorax; H, metanotum and abdomen.

Fig. 8

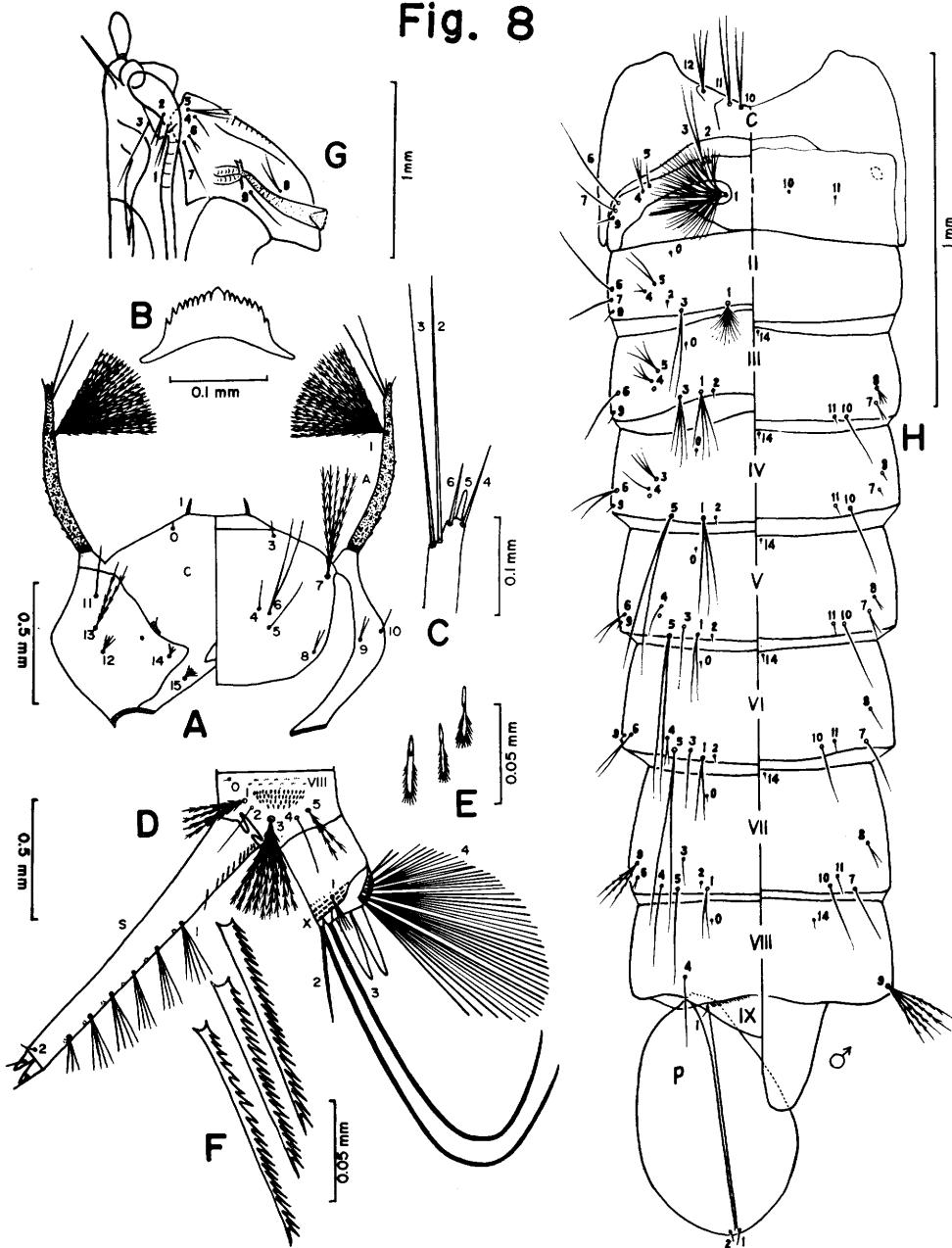


Fig. 8. *Culex lini*, n.sp.; A-F, larva; A, head; B, mentum; C, tip of antenna; D, terminal segments; E, comb scales; F, pecten teeth; G-H, pupa; G, cephalothorax; H, metanotum abdomen.

Fig. 9

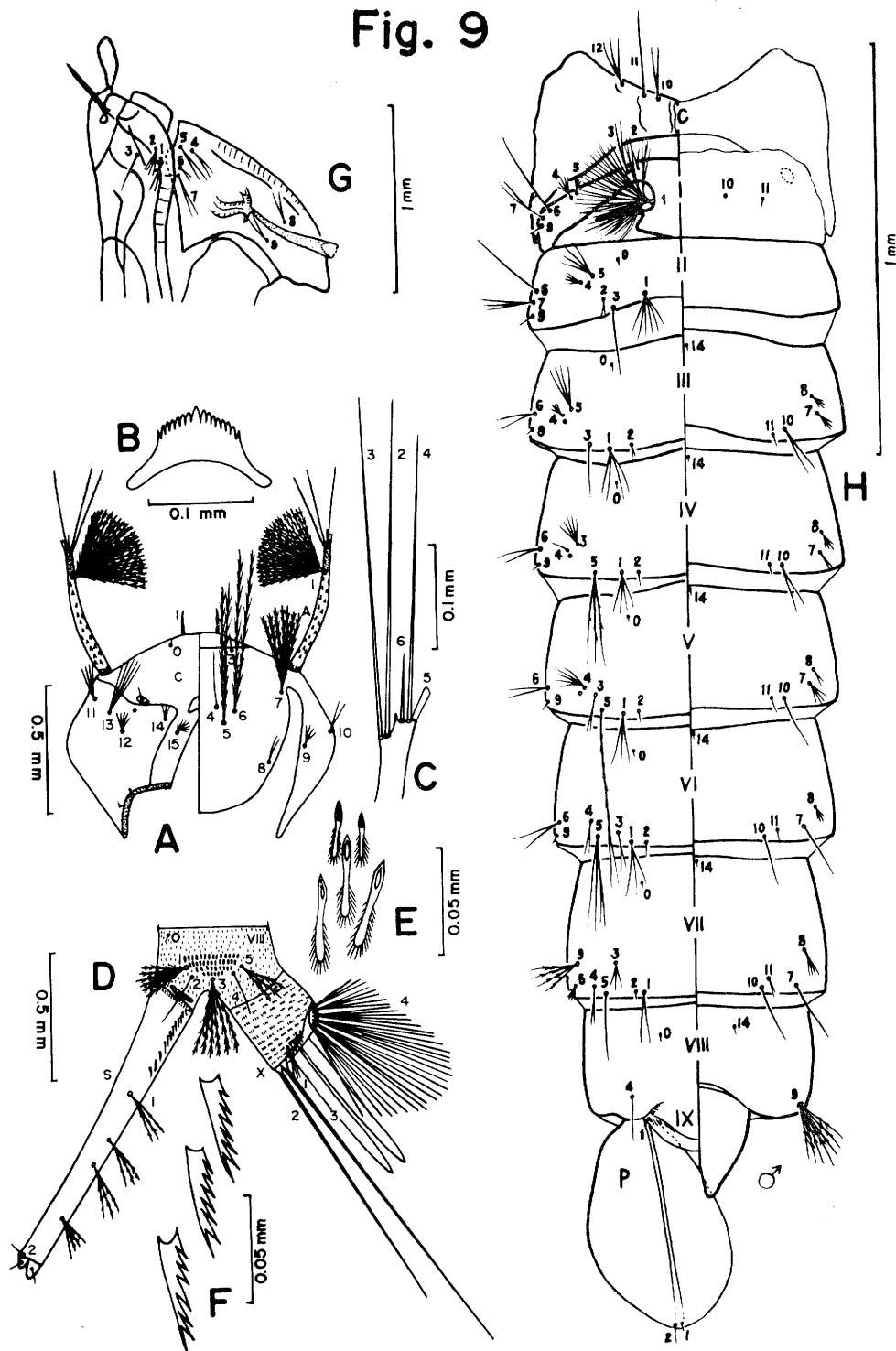


Fig. 9. *Culex hui*, n. sp.; A-F, larva; A, head; B, mentum; C, tip of antenna; D, terminal segments; E, comb scales; F, pecten teeth; G-H, pupa; G, cephalothorax; H, metanotum and abdomen.

Fig. 10

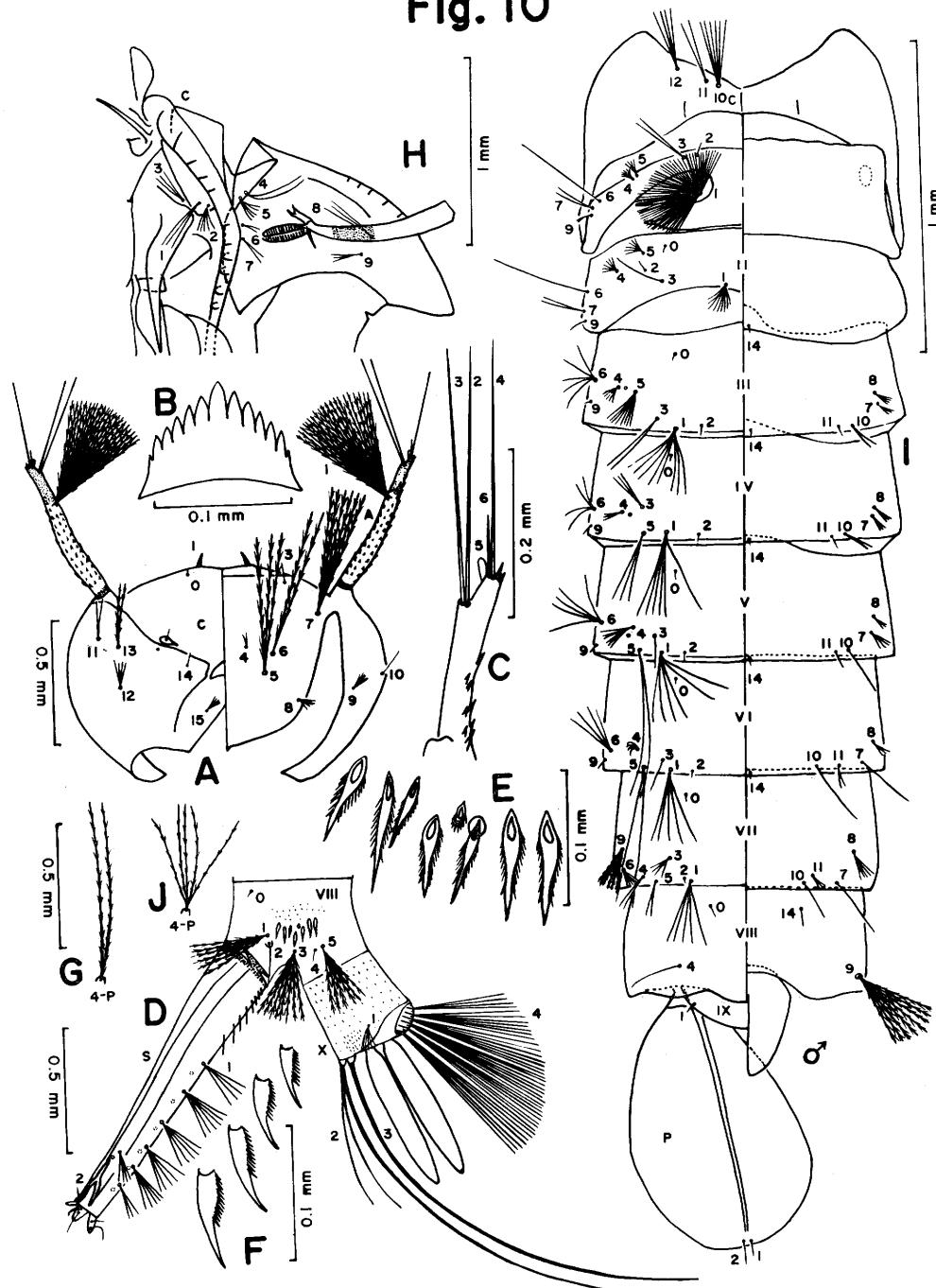


Fig. 10. A-I, *Culex neovishnui*, n. sp.; A-G, larva; A, head; B, mentum; C, tip of antenna; D, terminal segments; E, comb teeth; F, pecten teeth; G, prothoracic hair 4-P; H-I, pupa; H, cephalothorax; I, metanotum and abdomen; J, prothoracic hair 4-P of *Culex pseudovishnui* of Singapore.

Fig. 11

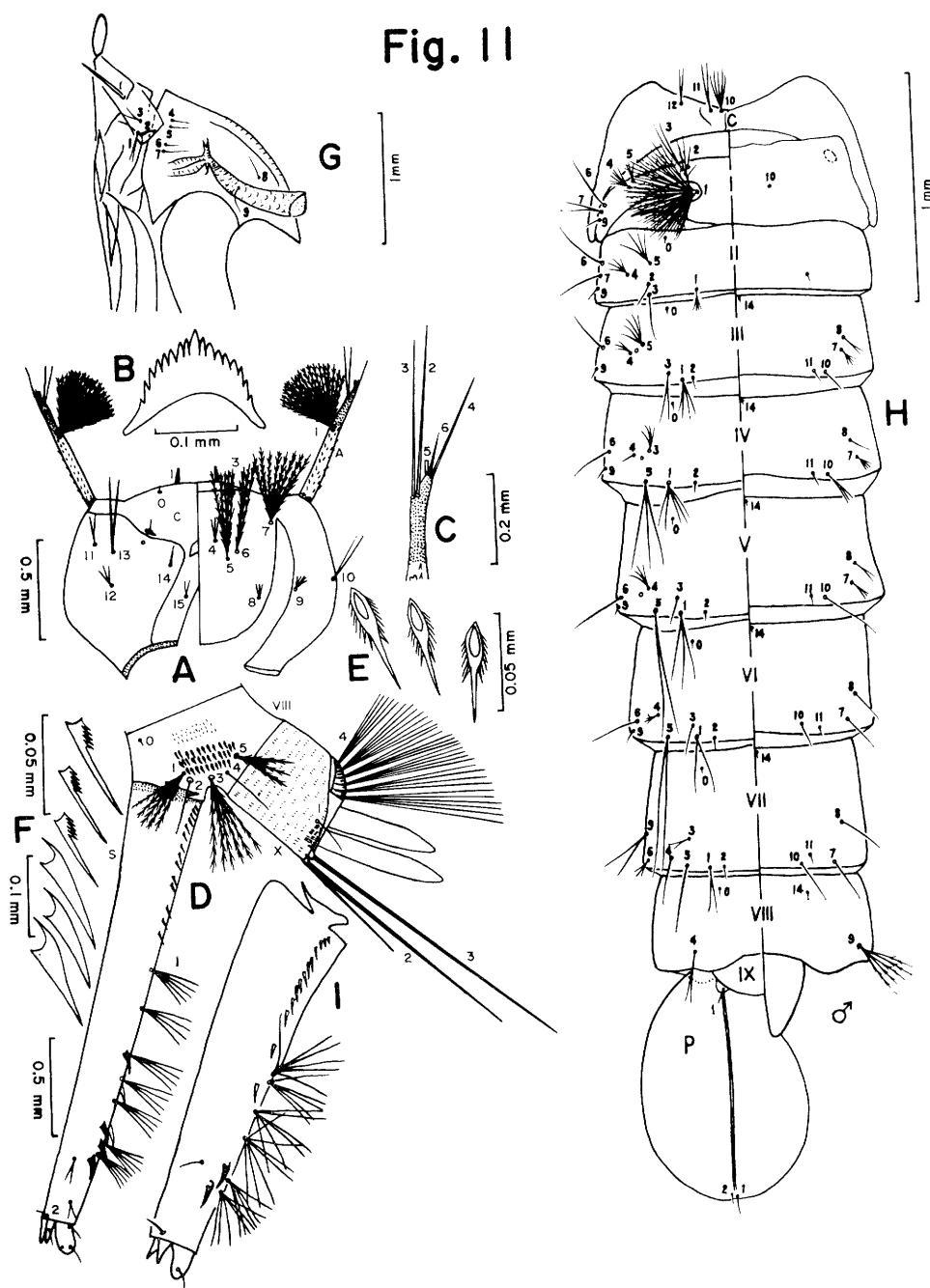


Fig. 11. A-H, *Culex kangi*, n. sp.; A-F, larva; A, head; B, mentum; C, tip of antenna; D, terminal segments; E, comb teeth; F, pecten teeth; G-H, pupa; G, cephalothorax; H, metanotum and abdomen; I, larval siphon of paratype female of *Culex jacksoni* (by Dr. P. F. Mattingly, personal communication, 1965).

Fig. 12

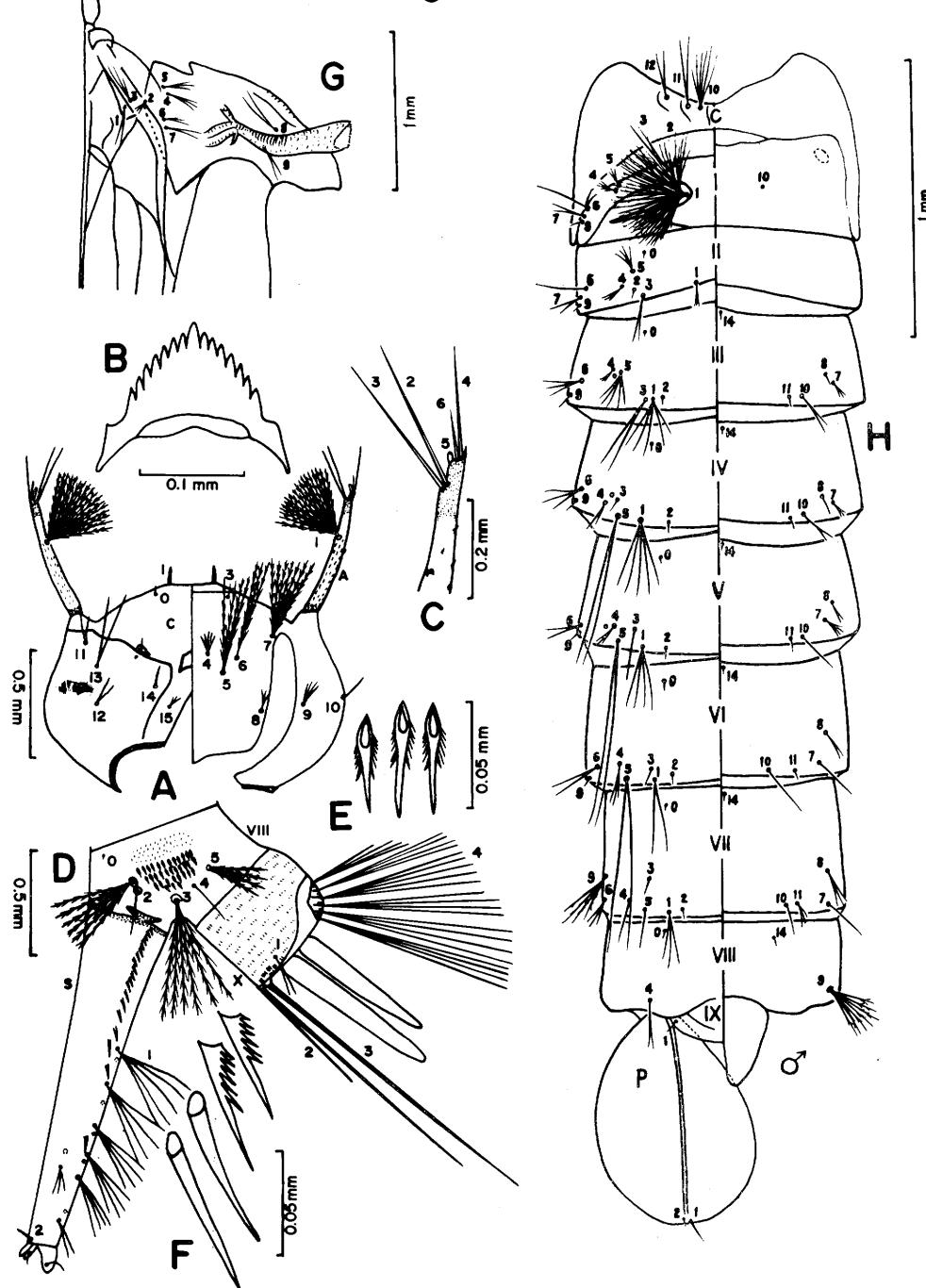


Fig. 12. A-H, *Culex tsengi*, n. sp.; A-F, larva; A, head; B, mentum; C, tip of antenna; D, terminal segments; E, comb teeth; F, pecten teeth; G-H, pupa; G, cephalothorax; H, metanotum and abdomen.

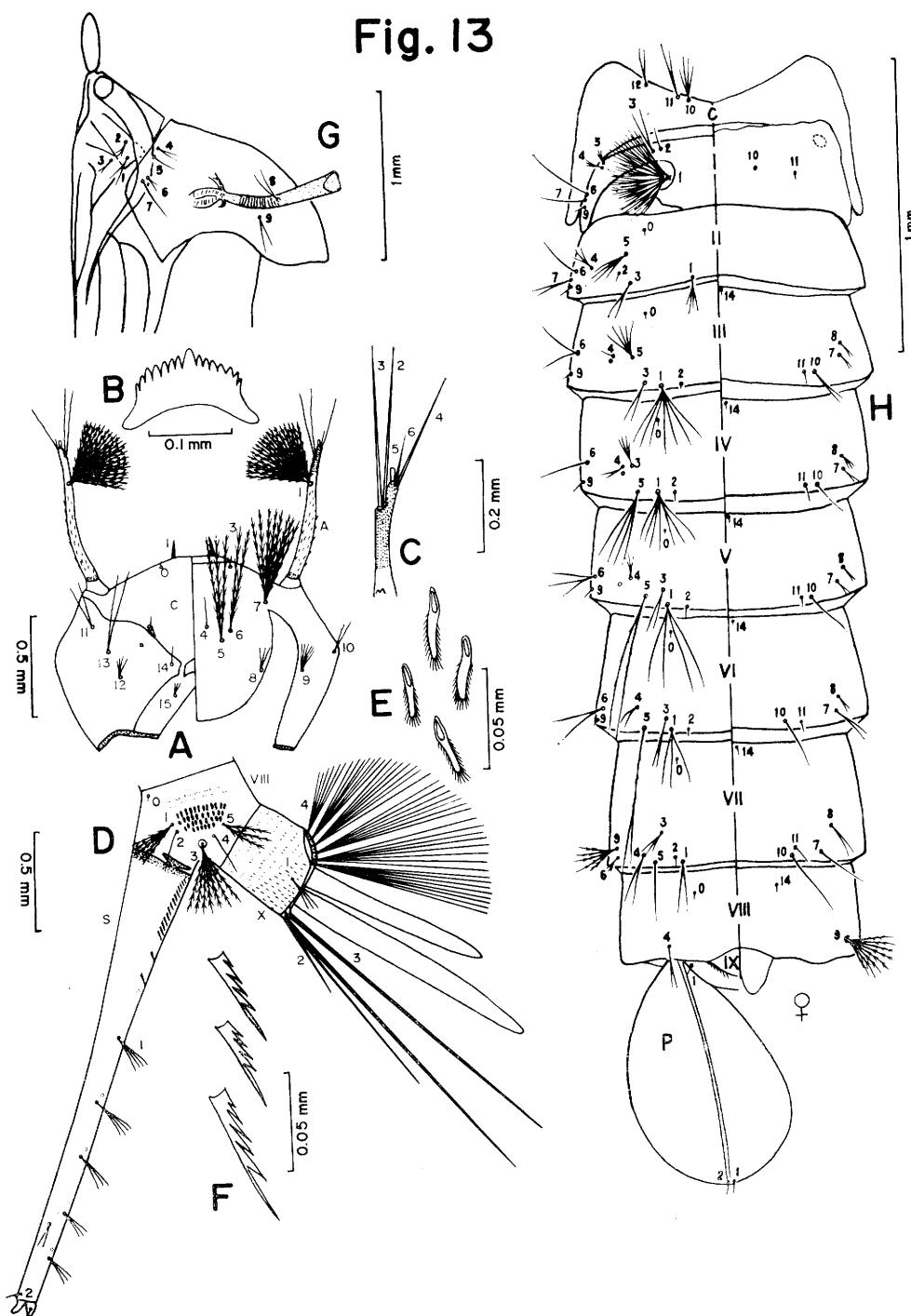


Fig. 13. *A-H, Culex neomimulus*, n. sp.; A-F, larva; A, head; B, mentum; C, tip of antenna; D, terminal segments; E, comb teeth; F, pecten teeth; G-H, pupa; G cephalothorax; H, metanotum and abdomen.

Fig. 14

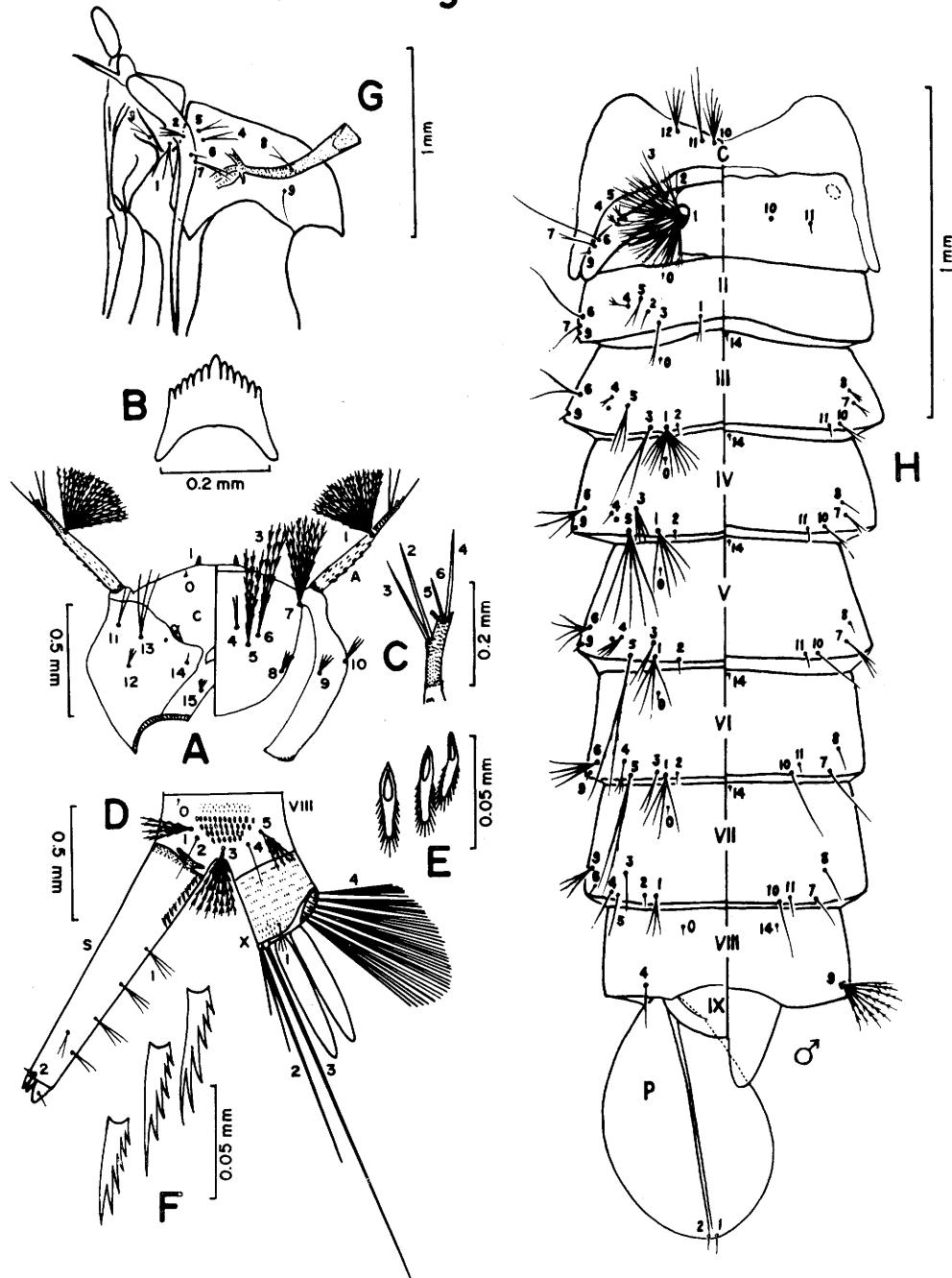


Fig. 14. *Culex murrelli*, n. sp.; A-F, larva; A, head; B, mentum; C, tip of antenna; D, terminal segments; E, comb teeth; F, pecten teeth; G-H, pupa; G, cephalothorax; H, metanotum and abdomen.